7299sl Monitor
Service Guide

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Chapter 1

SYSTEM OVERVIEW

1.1 Introduction

This specification describes a low-cost high performance 19" color auto-scan monitor which will operate with high-end Windows and CAD/CAM applications. This intelligent monitor is microprocessor controlled with a powerful memory base of pre-programmed screen and input configurations. It also allows users to place their own settings into memory via external controls. It's setting status is indicated on screen. It is compatible with various kind of computers and graphics adapters it synchronizes automatically with the signal from 30KHz to 98k Hz horizontal frequency and from 50Hz to 160Hz Vertical scan frequency. When it works on 1024 x 768 non-interlaced/70Hz mode, the refresh rate for flicker-free high quality image will help to reduce eyestrain. A power management function has been designed to save power consumption and power management is compliant with VESA & TCO. The monitor is available with two industrial designs: one for ACER and the other for OEM.

It has the following features:

-With unique design of iScreen
-Auto range power supply
-0.26mm dot pitch CRT.
-User controls: Power switch, Auto Calibrating, Control keys.
-On screen control keys for user:
Enter key : enter sub-menus or select items
Exit key : Enter OSD or back to main menus (auto save), or leave OSD.
Left key : For left adjustment and enter contrast hot-key function.
Right key : For right adjustment and enter brightness hot-key function

-Power on/off indicator
-Power on auto degaussing
-20 seconds auto save function
-Total 20 modes for factory and user settings
-Tilt and swivel base
-Detachable power cable
-VGA resolution at 31.5kHz
640 X 400
640 X 480

-SVGA resolution: 800 X 600 from 34kHz to 54kHz
-UVGA resolution: 1024 X 768(non-interlaced) from 48KHz to 68KHz
-WS resolution : 1280 X 1024 (non-interlaced) from 64KHz to 98KHz
-VESA resolution : 1600 X 1200 (non-interlaced) at 81kHz
-Automatic scanning all horizontal frequencies from 30KHz to 98KHz,add all vertical frequencies between 50Hz and 160Hz
-Power management function
-TCO
-DDC1/DDC2B
-USB optional

1.2 Operational Specification

1.2.1 Environment

1.2.1.1 Temperature

-Operating	+5 to +40 degrees Celsius
-Non-operating	-20 to + 60 degrees Celsius

1.2.1.2 Humidity

-Operating	20% to 90% non-condensing
-Non-operating	10% to 90% non-condensing

1.2.1.3 Altitude

-Operating	0 to 3,048m (10,000ft)
-Non-operating	0 to 12,192m (40,000ft)

-Operating condition / without packing

-Non-operating condition / with packing

1.2.2 Transportation

1.2.2.1 Vibration Test (Package, Non-Operating)

A) Sine-wave Vibration

Frequency (Hz)	Status
5 ~ 26.6	0.6G
26.6 ~ 50	0.016"
50 ~ 500	1.5G

* Duration : 104 Minutes / Per Axis (X,Y, and Z Axis)
-Total Test Time : 312 Minutes

B) Random Vibration

Frequency (Hz)	Slope (dB/Oct.)	Spectrum Level (g2/Hz)
5 ~ 100	0	0.015
100 ~ 200	-6	---
200	---	0.0038

Equivalent to 1.47 Grms
* Duration : 30 Minutes / Per Axis (X,Y, and Z Axis)
-Total Test Time : 90 Minutes

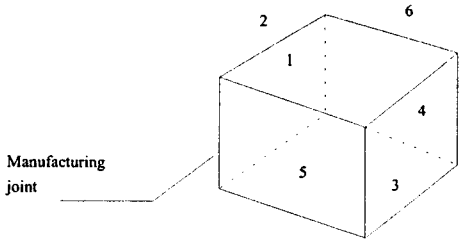
1.2.2.2 Drop Test (with packing)

A) Drop Height

PKG. Gross Wt.	Height (cm)
0 - 9	91
> 9 - 18.2	76
> 18.2 - 27.2	61
> 27.2 - 45.4	46
> 45.4 - 68.1	31
> 68.1 - 113.5	26

B) Drop Sequence

Surface
1. Top
2. Front
3. Bottom
4. Rear
5. Left
6. Right



-Corner 5-3-2 select at weakness side [the low left(or right) corner of the front panel]
-An edge drop with impact on the shortest edge radiating from corner 5-3-2
-An edge drop with impact on the next shortest edge radiating from corner 5-3-2
-An edge drop with impact on the longest edge radiating from corner 5-3-2
-A flat drop with impact on the rear
-A flat drop with impact on the front
-A flat drop with impact on the right
-A flat drop with impact on the left
-A flat drop with impact on the bottom
-A flat drop with impact on the top
After test, there is no electrical and mechanical damage permitted.

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1.2.3 Packing Configuration

1.2.3.1 Container Specification

1.2.3.1.1 Shipping Container

Container Type		20'*8'*8'6" Steel	40'*8'*8'6" Steel	40'*8'*9'6"
				High Cube Steel
	Gross	24,000	30,480	30,480
Weight(Kgw)	Tare	2,370	4,000	4,200
	Payload	21,630	26,480	26,280
Interior Measurement	Length	5,898	12,031	12,031
(mm)	Width	2,352	2,352	2,352
	Height	2,394	2,394	2,699
Volume(Cubic Meter)		33.2	67.74	76.4
Door opening(mm)	Width	2,340	2,340	2,340
	Height	2,280	2,280	2,585
Useable Interior Dimension (Duducted pallet(130mm & Operating spce 50mm)	Length	5,890	12,000	12,000
	Width	2,330	2,330	2,330
	Height	2,100	2,100	2,405

1.2.3.1.2 Air Transport

Container Type		Container (1)	Container (2)	Container (3)
		125"*96"*96"	125"*96"*118"	125"*88"*64"
Weight(Kgw)	Gross	6,804	6,804	4,627
	Tare	129	129	129
	Payload	6,675	6,675	4,498
Interior Measurement (mm)	Length	3,048	3,048	3,048
	Width	2,260	2,260	2,082
	Height	2,438	2,997	1,625
Volume(Cubic Meter)		17	19	11

1.2.3.2 Carton Specification

Product	Net	21.0
Weight(Kgw)	Gross	25.1
Carton Interior	Length	574
Measurement(mm)	Width	545
	Height	600

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Carton External	Length	594
Measurement(mm)	Width	565
	Height	632

1.2.3.3 Container Stowing & Carrying Specification

1.2.3.3.1 Dimension

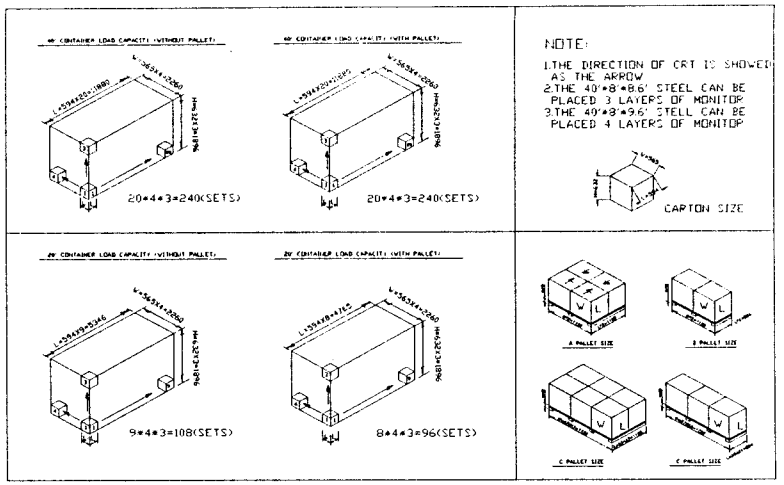
Transport Type		Pallet A	Pallet B	Pallet C
Shipping Pallet	Length	990	X	X
Dimension(mm)	Width	1130	X	X
	Height	130	X	X
Air Transport Pallet	Length	990	X	X
Dimension(mm)	Width	1130	X	X
	Height	130	X	X

1.2.3.4 Container Carrying Capacity

2.3.4.1 Shipping Container

Stowing Type		Quantity of products (sets)	Quantity of Products (sets)	Quantity of pallet (sets)
		(Every container)	(Every Pallet)	(Every Container)
	20'	96	Pallet A: 12	Pallet A: 8
			Pallet B: X	Pallet B: X
with pallet	40'	240	Pallet A: 12	Pallet A: 20
			Pallet B: X	Pallet B: X
	20'	108	X	X
			X	X
Without pallet	40'	240	X	X
			X	X

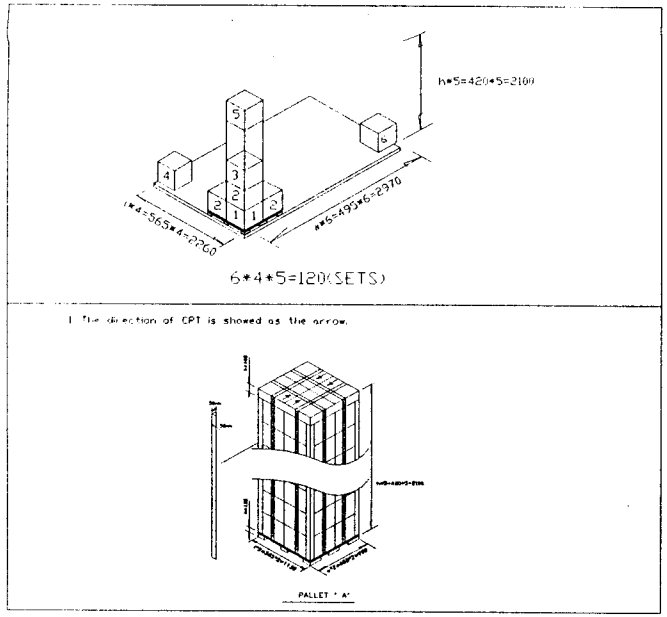
1.2.3.4.2 Shipping Container Stowing Method


20*4*3=240(SETS)
20*4*3=240(SETS)
NOTE:
1.THE DIRECTION OF CRT IS SHOWED AS THE ARROW
2.THE 40'*8*8.6' STEEL CAN BE PLACED 3 LAYERS OF MONITOR
3.THE 40'*8'*9.6' STELL CAN BE PLACED 4 LAYERS OF MONITOR
CARTON SIZE
9*4*3=108(SETS)
8*4*3=96(SETS)

1.2.3.4.3 Air Transport Container

Container Type	Quantity of products (sets) (Every container)	Quantity of Products (sets) (Every Pallet)	Quantity of pallet (sets) (Every Container)
Container 3048 * 2286 * 2438	120	Pallet A: 20 Pallet B: X	Pallet A: 6 Pallet B: X

1.2.3.4.4 Air Transport Container Stowing Method



1.2.4 Environmental Protection Design

Product is Per ES 715-c49 Environment Design Guide.

1.2.5 Electrostatic Discharge Requirements

The subject product must withstand up to 8KV voltage for contact discharge to the conduction surfaces andup to **15KV voltage for air discharge at insulating surfaces** of electrostatic discharge and meet therequirementas specified in ESD standard IEC801-2.

1.2.6 Safety Requirements

The display unit complies with the following safety standards and specifications.

1.2.6.1 110V Version

-UL compliance.standard for information technology equipment, UL 1950.

-CSA compliance.standard C22.2 No. 950-M93, information technology equipment.

-DHHS.rules 21 sub-chapter J as of date of manufacture

1.2.6.2 220V Version

-TUV compliance.EN60950 information technology equipment.
-PTB German X-ray emission standards.
-ZH1/618.German ergonomic standard.
-ISO9241-3.Ergonomic Requirements of Visual Display.
-Demko...EN60950.
-Nemko...EN60950.
-Semko...EN60950.
-Fimko... EN60950.
-CE marking compliance..73/23/EEC (CN60950)

1.2.7 EMI Requirements

This display unit complies with the following RFI rules and regulations.

1.2.7.1 110V Version

-FCC compliance.FCC Rule, Part 15, Subpart B, Class B.
-VCCI

1.2.7.2 220V Voltage

-CE Mark Compliance. 89/336/EEC.EN50082-1, IEC1000-4-2, IEC1000-4-3, IEC1000-4-4, IEC1000-4-5, IEC1000-4-6 ,EN50081-2, EN55022, CLASS B. IEC1000-3-2, IEC1000-3-3.
-DNSF compliance.,EN 55022, class B
-Low Radiation..MPRII 1990-10
-TCO'95

1.2.8 Acoustical Noise

With the display operating, the issue of sound measured is contained within 40 dB/A in the audible field.

1.2.9 Reliability

The Demonstration MTBF of the display unit shall be greater than 60,000 hours excluding the picture tube.

1.2.10 Mechanical Design for TCO 99:

1) Front Frame Reflectance:
   * Diffuse reflectance: > 20%
   * Gloss <= 30% gloss unit
2) Labeling of plastics:
   Plastic weight > 25g shall be marked in accordance with ISO11469
3) Variety of Plastic:
   All plastic components that weight > 100g shall be made from the same type of plastic.
4) Painting of Plastic:
   * Any plastic components that weight >100g shall not be painted lacquer or vanished, so that the paint, lacquer or vanish in dry matter exceed 1 weight-% of the plastic component.
   * Mould decoration (IMD) is not allowed
   All paints, lacquers, vanishes or colour additives used shall be declared by the type and mount.
5) Metallization of Plastic Housing:
   * Metallization is not allowed.
6) Plastic components > 25g shall not contain retardants of organically bound chloride or bromide.

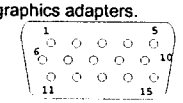
1.3. Input/Output Specifications

1.3.1 Input Signal Requirements

1.3.1.1 Signal cable (undetachable)

1.3.1.1.1 Video Inputs

- 15pin mini D-sub connector cable. The cable can catch-signal from IBM VGA, 8514A or compatible graphics adapters.



**15pin male D-sub connector

1	Red
2	Green
3	Blue
4	Ground
5	Ground
6	Red Ground
7	Green Ground
8	Blue Ground
9	PC5V (for DDC 1/2B+)
10	Ground
11	Ground

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12	SDA(for DDC 1/2B+)
13	H-Sync(H or H+V)
14	V-Sync
15	SCL(for DDC 1/2B+)

1.3.1.1.2 Cable length

1500mm +-20mm

1.3.1.2 Video signal

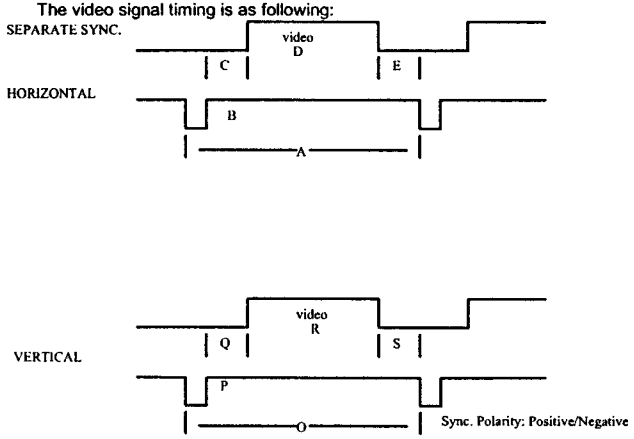
Analog 0.7 Vpp/75 ohm positive.

1.3.1.3 SYNC signal

-Separate SYNC : TTL level
-Horizontal SYNC : positive/negative
- Vertical SYNC : positive/negative
- Composite SYNC : TTL level, positive/negative

1.3.1.4 Timing

The video signal timing is as following:



PRESET TIMING

	1	2	3	4	5
	VGA	VGA	SVGA4	SVGA5	UVGA7
Fh	31.47kHz	31.47kHz	46.88 kHz	53.674 kHz	60.02 kHz
Aus	31.77	31.77	21.333	18.631	16.66
Bus	3.81	3.81	1.616	1.138	1.219
Cus	1.59	1.59	3.232	2.702	2.235
Dus	26.05	26.05	16.162	14.222	13.003
Eus	0.64	0.64	0.323	0.569	0.203
Fv	70.08Hz	59.94Hz	75Hz	85.062 Hz	75 Hz
Oms	14.27	16.68	13.333	11.756	13.328
Pms	0.064	0.064	0.064	0.056	0.05
Qms	0.86	0.76	0.448	0.503	0.466
Rms	13.157	15.762	12.8	11.179	12.795
Sms	0.191	0.095	0.021	0.018	0.017
Display Resolution	640*400	640*480	800*600	800*600	1024*768
Polarity H/V	-/+	-/-	-/-	+/+	+/+

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	6	7	8	9	
	UVGA8	WS7	WS8	VESA	
fh	68.677 kHz	79.98 kHz	91.146 kHz	81.019kHz	
Aus	14.561	12.504	10.971	12.343	
Bus	1.016	1.067	1.016	1.097	
Cus	2.201	1.837	1.422	1.737	
Dus	10.836	9.481	8.127	9.143	
Eus	0.058	0.119	0.406	0.366	
fv	84.996Hz	75Hz	85.024Hz	64.815Hz	
Oms	11.765	13.329	11.761	15.429	
Pms	0.044	0.038	0.033	0.037	
Qms	0.524	0.475	0.483	0.568	
Rms	11.183	12.804	11.235	14.811	
Sms	0.014	0.012	0.01	0.013	
Display Resolution	1024*768	1280*1024	1280*1024	1600*1200	
Polarity H/V	-/+	+/+	+/+	+/+	

1.3.1.5 Input signal Quality

(1) Rise/Fall time
Video Signal : less than 2.0ns
Horizontal SYNC : less than 50ns
Vertical SYNC : less than 100ns
(2) TTL Signal Level
The levels of Horizontal & Vertical SYNC will be TTL level, their high level will be 2.4-5.5V, and low level will be 0-0.2V.
(3) Video Signal Level
The video signal when terminated with an idea 75ohm termination will have a range of 0V to 0.7V(nominal), and its full scale output will be 0.7V and black level will be between 0V and 0.1V.

1.3.2 Power Supply Requirements

1.3.2.1 Input Power Requirements

(1) Input Voltage Range
The unit shall meet all the operating requirements with an input voltage range of 90-264 VAC (universal)
(2) Input Current
Maximum
Input Current Measuring Range
(MAX) 3.5 Arms 90Vac – 264Vac
(3) Frequency Range
The unit shall operate within a frequency range of 47Hz to 63Hz.
(4) Inrush Current
Power supply inrush current shall be less than 60A for all conditions of line voltage (cold-start).

(5) Regulator Efficiency
70% minimum (measuring at 115Vac and full load)
(6) Power line Transient Immunity
The power supply shall function properly after being subjected to a 0.3us/1.2us, 2000 volt high peak pulse, or 5ns/10ns, 1500 volt fast peak pulse applied either differentially or single endedly to line and neutral at any phase of the power line voltage and shall not cause an unsafe or unrecoverable errors to the horizontal frequency of the display unit.
(7) Maximum power consumption: 135 Watts (preset size); 150W (with USB function)

1.3.2.2 Output Power Requirements

The power circuit shall supply DC power outputs as followings:

Output	Nominal	Regulation	Load Current Range
1	17V	±3%	0.4-0.9A

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2	80V	±3%	0.02-0.13A
3	24V	±3%	0.05-0.1A
4	6.5V	±3%	0.4-0.95A
5	200V	±3%	0.2-0.5A
6	5V	±3%	0.1-2A

1.3.2.3 AC Power Inlet

The display unit shall be supplied with an AC power NICOON NC-174(or equivalent), to be located at the rear of the display.

1.3.2.4 Power Cord

Each display unit shall be supplied with a power cord, with length of 1800mm king cord KC-003 or equivalent.

1.3.2.5 Power Management Function

Mode	Power Consumption	H/V Sync	LED Color & status	Heater voltage	Recovery Time
Normal	Normal	Both exist	Green (Normal)	Yes	---------
Stand-by	15W Max	H off/V ON	Amber	Yes	3sec
Suspend	5W Max	H ON/V off	Amber(Blinking)	None	5 sec
Off	5W Max	None	Amber(Blinking)	None	5 sec
**Override	Normal	None	Green(Normal)	Yes	---------

1.3.3 CRT Requirements

The color picture tube is a 19 inch, 100 degrees, and have the following features:
-Type: shadow mask
-Dot pitch: 0.26mm dot trio pitch on phosphor screen
-Phosphor: Medium-short persistence red, green and phosphor
-Light transmittance: 44% at center.
-Face plate treatment: Anti-Reflection & Anti-Static Coating
-Double focus.

1.4. Functional Specifications

All the tests to verify specifications in this section must be performed under the following standard conditions unless otherwise noted. The standard conditions are:

- Temperature: 25 +-5 degree Celsius
- Magnetic field: No additional magnetic field in near side, CRT faces to East.
- AC line input voltage. 90Vac ~ 264Vac., 50HZ ~ 60HZ
- Checking display mode: ALL the presenting modes, as 3.1.4 shown.
- Warm up time > 30min.

1.4.1 Display Quality

1.4.1.1 Display Date Area (with 20 ft-1 at full white pattern ,all preset mode)

(1) Horizontal 360 +-4mm.
(2) Vertical 270 +-4mm.

1.4.1.2 Video AMP Performance

(1) Dot frequency : 176MHZ.
(2) Resolution : 1600 X 1200 max(center)
(3) Effective rise/fall time : 5.5 ns typical.
(4) Overshoot/undershoot : 10% max, first overshoot / undershoot.
4% max, second overshoot / undershoot.
1% max, third overshoot / undershoot.
(5) Sag: 5% max (at horizontal freq.)

1.4.1.3 Light Output (test mode : SVGA5: 800*600)

(1) Raster (Brightness at max) : 0.5~1.0 Ft-L
(2) At 3" block pattern (Brightness at cut-off, contrast at max., ABL is non-working) : 40 Ft-L
(3) At full-white pattern (Brightness at cut-off, contrast at max., ABL is working): 28Ft-L

1.4.1.4 Contrast Adjustment Range: over 15db

1.4.1.5 Brightness Adjustment Range

At contrast control set at maximum level, adjusting brightness control from minimum setting to maximum setting, the light output of 3" block pattern should be increased more than 15 dB.
If both brightness and contrast control are minimum, the 3" block should be extinguished.

1.4.1.6 Linearity (set to 20 Ft-L at full white pattern first) 10x8 crosshatch pattern:

(1) Vertical Non-linearity 5 % max, as Fig.1. Formula :

$$\frac{Ymax - Ymin}{Ymax + Ymin} \times 100\% < 5\%$$

(2) Horizontal Non-linearity 5 % max, as Fig.1. Formula

$$\frac{Xmax - Xmin}{Xmax + Xmin} \times 100\% < 5\%$$

1.4.1.7 Geometric Distortion (with 20Ft-L at full white pattern)

(1) Top/Bottom Pincushion 2.0 mm max. as Fig.2 Δy1 or Δy2
(2) Side Pincushion 2.0 mm max. as Fig.2 Δx1 or Δx2
(3) Top/Bottom Barreling 2.0 mm max. as Fig.3 Δy1 or Δy2
(4) Side Barreling 2.0 mm max. as Fig.3 Δx1 or Δx2
(5) Vertical Trapezoid 3.0 mm max. as Fig.4 AD-BC|
(6) Horizontal Trapezoid 3.0 mm max. as Fig.4 |AB-CD|
(7) Tilt 1.2 mm max. as Fig.5 b1 or b2
(8) Orthogonality (TCO99) : $\frac{|H1-H2|}{0.5(H1+H2)} \le 0.02, \frac{|V1-V2|}{0.5(V1+V2)} \le 0.02, \frac{|D1-D2|}{0.5(D1+D2)} \le 0.03$, as Fig.5
(9) Picture Centering 6.0 mm max. as Fig.5
(10) S-curve 1.5 mm max.
(11).Linearity (TCO99) 1% max. as Fig.2 Δx1/x or Δy1/y

1.4.1.8 Size Stability

Picture growth from 5 Ft-L to maximum Ft-L shall be less than 2mm with full white pattern (double side).

1.4.1.9 Swing & Jitter

-Swing are not permitted in the conditions stated as followings : the distance of watch is 30cm from eyes to screen.
- Jitter of character location < 0.1 mm (DIN 66234 T2, TCO99)

1.4.1.10 Focus (The distance of watch is 30cm from eyes to screen)

Under the condition of luminance of 20Ft-L at full-white pattern (brightness control factory setting , contrast control adjusted), all # characters on the screen in the "#" pattern will be clear.

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1.4.1.11 DDC1/2B Table

Address	Data	Description
00	00	
01	FF	
02	FF	
03	FF	
04	FF	
05	FF	
06	FF	
07	00	
08	06	ID Manufacturer Name = API
09	09	
0A	21	ID Product Code = 7299sl (21,97)
0B	97	
0C	*	ID Serial Number
0D	*	
0E	*	
0F	*	
10	*	Week of Manufacture
11	*	Year of Manufacture
12	01	EDID version
13	01	Revision
14	0E	Video Input Define (see Note 1)
15	24	Max. H. Image Size (0-FF cm)
16	1B	Max. V. Image Size (0-FF cm)
17	A6	(gamma*100)-100 range [1.00 to 3.55]
18	E8	DPMS (see Note 2)
19	0F	Red Green Bits Rx1Rx0Rxy1Ry0Gx1Gx0Gy1Gy0
1A	6E	Blue White Bits Bx1Bx0By1By0Wx1Wx0Wy1Wy0
1B	A0	Red x bit9-2
1C	57	Red y bit9-2
1D	48	Green x bit9-2
1E	9A	Green y bits9-2 (see Note 3)
1F	26	Blue x bit9-2
20	10	Blue y bit9-2
21	47	White x bit9-2
22	4F	White y bit9-2
23	A0	Established Timing I
24	43	Established Timing II (see Note 4)
25	00	Established Timing III
26	45	Standard Timing Identification
27	59	#1 800*600 / 85HZ
28	61	#2
29	59	1024*768 / 85HZ
2A	81	#3
2B	99	1280*1204 / 85HZ
2C	A9	#4
2D	45	1600*1200 / 65HZ
2E	01	#5
2F	01	
30	01	#6
31	01	
32	01	#7
33	01	
34	01	#8
35	01	
36	00	Detailed Timing Description # 1
37	00	
38	00	This Detailed Timing Description :
39	FE	ASCII String "Monitor"
3A	00	
3B	4D	
3C	6F	
3D	6E	
3E	69	
3F	74	
40	6F	
41	72	
42	0A	
43	20	
44	20	
45	20	
46	20	
47	20	
48	00	Detailed Timing Description # 2
49	00	
4A	00	This Detailed Timing Description :
4B	FE	ASCII String "Monitor"
4C	00	
4D	4D	
4E	6F	
4F	6E	
50	69	
51	74	
52	6F	
53	72	
54	0A	
55	20	
56	20	
57	20	
58	20	
59	20	
5A	00	Detailed Timing Description # 3
5B	00	
5C	00	This Detailed Timing Description :
5D	FE	ASCII String "Monitor"
5E	00	
5F	4D	
60	6F	
61	6E	
62	69	
63	74	
64	6F	
65	72	
66	0A	
67	20	
68	20	
69	20	
6A	20	
6B	20	
6C	00	Detailed Timing Description #4
6D	00	
6E	00	This Detailed Timing Description :
6F	FE	ASCII String "Monitor"
70	00	
71	4D	
72	6F	
73	6E	
74	69	
75	74	

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76	6F	
77	72	
78	0A	
79	20	
7A	20	
7B	20	
7C	20	
7D	20	
7E	00	Extension Flag
7F	*	Check sum

Serial number format : API
Bar code ID of model name : 9S

Note 1

Bit	Description		
7	Analog / Digital Input : Defines usage of the rest if the byte as "analog input" or digital input". Analog=0, Digital=1 . If input is described as analog, the following definitions apply to bits 6-0.		
6:5	Signal Level Standard (6:5) : Refer to the following bit definitions. Identified by the level of reference white volts above blank, followed by the level of the sync tips in volts below Blank. Bit 6 Bit 5 Operation 0 0 0.700V/0.300V (1.000V p-p) 0 1 0.714V/0.286V (1.000V p-p) 1 0 1.000V/0.400V (1.400V p-p) 1 1 0.700V/0.000V (0.700V P-P)		
4	Setup: If set, the display is set to expect a blank-to-black setup or pedestal per the Appropriate signal level standard.		
3:0	Sync Inputs (See Bit Operation below)		
	3	Separate Sync	
	2	Composite Sync (on H Sync line)	
	1	Sync on Green Video	
	0	Serration of the V.Sync Pulse is required when composite sync or sync-on-green video is used	

Note 2

Bit 7	Stand-by
Bit 6	Suspend
Bit 5	Active off
Bit 4-3	Display Type
	0,0 - Monochrome/gray scale display 0,1 - RGB color display 1,0 - Non-RGB multicolor display (example:RGY) 1,1 - Undefined.
Bit 2-0	Reserved. Set at 00h until defined.

Note 3

CRT Vender	Red (x/y)	Green (x/y)	Blue (x/y)	Gamma
Hitachi	0.625/0.340	0.285/0.605	0.150/0.065	2.66

Note 4

Byte 1	bit	Established Timings I	Source
	7	640*400 @ 70Hz (720x400)	(VGA, IBM)
	6	720*400 @ 88Hz	(XGA2, IBM)
	5	640*480 @ 60Hz	(VGA, IBM)
	4	640*480 @ 67Hz	(Mac II, Apple)
	3	640*480 @ 72Hz	(VESA)
	2	640*480 @ 75Hz	(VESA)
	1	800*600 @ 56Hz	(VESA)
	0	800*600 @ 60Hz	(VESA)
Byte 2	bit	Established Timings II	
	7	800*600 @ 72Hz	(VESA)
	6	800*600 @ 75Hz	(VESA)
	5	832*624 @ 75Hz	(Mac II, Apple)
	4	1024*768 @ 87Hz (interlaced)	(IBM)
	3	1024*768 @ 60Hz	(VESA)
	2	1024*768 @ 70Hz	(VESA)
	1	1024*768 @ 75HZ	(VESA)
	0	1280*1024 @ 75HZ	(VESA)
Byte 3	bit	Manufacturer's Timings	Manufacturer's Specified Timing
	7	1152*870 @ 75Hz	(Mac II, Apple)
	6	Reserved	
	5	Reserved	
	4	Reserved	
	3	Reserved	
	2	Reserved	
	1	Reserved	
	0	Reserved	

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1.4.1.12 USB (Universal Serial Bus)

(1) Introduction:

The USB stand alones hub for monitor is designed to provide USB expandability in a PC system and plug and play control of the monitor . The USB IC is used in a micro controller based monitor and communicates with the monitor system over the I^2C serial bus hub.

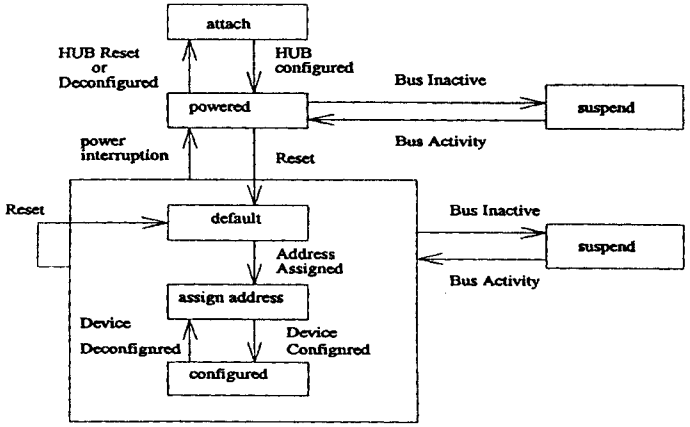
Since the device is a compound USB device (hab function plus embedded function), the embedded function appears as PORT1 to the hose system. The four expansion ports are number 2 through 5.

(2) I^2C Interface

The I^2C bus is used to interface to an external micro-controller needed to control the operation of the hub when the SUB chip need to communicate with the micro-controller if asserts an interrupt signal. The micro-comptroller services this interrupt by reading the appropriate status register on the SUB chip through I^2C bus.

(3) USB device states

A USB device has several possible states. Some of these states are visible to the USB and the host and others are internal to the USB device. The following diagram describes these states.

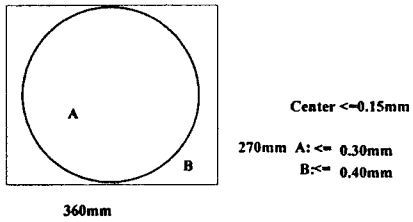


1.4.2 Color Quality

1.4.2.1 Misconvergence

Use "crosshatch" white pattern, then set the brightness control at weight number is 50 & contrast control max. to examine the convergence.

The misconvergence must strictly meet the requirements stated as follows:



1.4.2.2 Moire (the distance of watch is 30cm from eyes to screen)

In the pattern of all green, all blue, all red, or all white, and the luminance is 18Ft-L, moire is not allowed to appear,(Limit samples should be used by mutual agreement , if necessary).

1.4.2.3 Impurity

Impurity should not appear in the pattern of all green, all blue, all red, or all white, the brightness is 0 to max. Ft-L and the screen display is set to east direction.

1.4.2.4 White Balance

The following 5 different white balance is required to meet the specifications of x. y variety value 4% when the unit is set to "28 Ft-L, full white pattern cut-off", and the specifications of x.y variety value 10% when the unit is set to "5~max. Ft-L, cut-off, 3" block pattern"

a. Color temperature for TCO95/MPRII

Color Temperature	x	y
11500°K	0.272	0.283
9300°K	0.283	0.297
7100°K	0.304	0.320
6500°K	0.313	0.329
5500°K	0.333	0.348

b. Color temperature for TCO99:

Color Temperature	x	y	u'	v'
11500°K	0.272	0.283	0.186	0.435
9300°K	0.283	0.297	0.189	0.446
7100°K	0.304	0.320	0.195	0.462
6500°K	0.313	0.329	0.198	0.468
5500°K	0.333	0.348	0.204	0.481

1.4.2.5 Color Uniformity

The unit is set to "28 Ft-L, full white pattern, cut-off" and then measure the color temperature between any two point of display area. The difference of the color temperature must be :

$\Delta x <= 4\%, \Delta y <= 4\%$.

1.4.2.6 Luminance Uniformity

A		B	90mm
	E		90mm
C		D	90mm
120mm	120mm	120mm	

The E area is set to "28 Ft-L, full white pattern, cutoff" and then measure the A, B, C, and D areas to get the max. and min. light output values in these 5 areas.

$$\frac{L_{MAX}}{L_{MIN}} \leq 1.5$$

1.4.2.7 Degaussing

Degaussing shall occur automatically when the monitor is turned on and shall be sufficient to demagnetize the CRT to any possible change in Earth's magnetic field from movement or shipment. Degaussing shall occur by manual when the monitor is setting at color adjust.

1.4.3 OSD Operation Procedure

There are 4 keys for user's control. The following descriptions are the introduction of these keys.

- **Enter** key : enter sub-menus or select items
- **Exit** key : Enter OSD or back to main menus (auto save), or leave OSD.
- **Left** key : For left adjustment and enter contrast hot-key function.
- **Right** key : For right adjustment and enter contrast hot-key function

OSD Operation procedure:

A. Contrast hot-key mode

1. Press **Left** key to enter contrast hot-key mode
2. Press **Left** and **Right** keys to do the adjustments.

B. Brightness hot-key mode

1. Press Right key to enter brightness hot-key mode
2. Press Left or Right keys to do the adjustments.

C. Main menu mode

1. Press Enter or Exit keys to enter Main menu (there are one main menu)
2. Press Left or Right keys to scroll light pane to desired items,. then press Enter key to enter sub-menus.
3. Press Left or Right keys to scroll light pane to desired items, then press Enter key to select the items.
4. Press Left or Right keys to do the adjustments.
5. Press Exit key to save and back to main menus.
6. Press Exit key to save and leave OSD

Detail page assignment of main menu is as below :
Main Menu : Press **Enter** or **Exit** keys to enter main menu
This main menu includes seven items :

1. **Luminance adjustment**

Press **Enter** key to enter sub-menus, and press **Left** or **Right** keys to scroll light pane to desired items.
There are two items :

Contrast **Brightness**

Press **Enter** to select the items. Then press **Left** or **Right** keys to do adjustment.

2. **Geometry**

Press **Enter** key to enter sub-menus, and press **Left** or **Right** keys to scroll light panel to desired items. There are 10 items :

Hor. (horizontal) Position
Hor. Size
Ver. (vertical) Position
Ver. Size
Tilt (Rotation)
Pincushion
Unbalance
Trapezoid
Parallelogram
Top Corner
Bottom Corner

Press **Enter** to select the items, and press **Left** or **Right** keys to do adjustment

3. **Color Adjustment**

Press **Enter** key to enter sub-menus, and press **Left** or **Right** keys to scroll light panel to desired color temperature, press **Exit** to save and exit or press **Enter** for RGB adjustment. There are 5 color mode :

Color mode	Color Temperature Preset
C1	9300K
C2	6500K
C3	5500K
C4	7100K
C5	11500K

Press **Enter** key to enter RGB adjust function. Press **Left** or **Right** keys to scroll light panel to desired items. There are 4 items :

R Red gain adjustment
G Green gain adjustment
B Blue gain adjustment
Reset to Default

Press **Enter** to select the items. Then press **Left** or **Right** keys to do adjustment.

4. **Reset to Default**
5. **Degauss**
6. Miscellaneous

Press **Enter** key to enter sub-menus
Press **Left** or **Right** keys to scroll light pane to desired items
There are 5 items

Hor. Moire
Ver. Moire
OSD Position
Language Select

Press **Enter** key to enter sub-menus .

A. **For Hor. Moire adjustment**
Press **Enter** to select the items. Then press **Left** or **Right** keys to adjust.

B. **For Ver. Moire adjustment**

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Press **Enter** to select the items. Then press **Left** or **Right** keys to adjust.

C. **For OSD Position adjustment**
Press Left or Right keys to scroll light pane to desired items :
Hor.(horizontal) Position
Ver. (vertical) Position
Press **Enter** to select the items. Then press **Left** or **Right** keys to adjust.

D. **For Language Select**
Press Left or Right keys to scroll light pane to desired language, press Exit to save and exit.

De	Deutsch
En	English
Es	Espanol
Fr	France
It	Italiano

1.5.Physical Specifications

1.5.1 Physical Dimension & Appearance

1.5.1.1 Overall Dimension
460mm (W) X 475mm (H) X 428mm(D)
1.5.1.2 Net weight
21.0kg
1.5.1.3 Outer Appearance
See Fig.6 & Fig.7

1.5.2 Construction and Materials on outer surface

-Materials: Plastic
-Color: Light Gray

1.5.3 Base & Swivel

- Tilt: - 5 / +15 degrees
- Swivel:- 45 / + 45 degrees

1.5.4 Marking & Labels

1.5.4.1 Reference Label(Rear panel)
(1) Reference numbers
(2) Manufacture data
(3) Agency Approvals
(4) Power Ratings
1.5.4.2 Controls & Connectors
(1) AC power cord input: abbreviated labels
(2) User's Controls: standard print

1.5.5 Packing

1.5.5.1 Carton Dimension
594mm (L) X632mm (H) X565mm (W)
1.5.5.2 Shipping Weight
25.1kg

1.6. Maintainability Specifications

1.6.1 General & Requirements

1.6.1.1 Installation
From outside of unit with standard tools and documentation provided to user.
1.6.1.2 Periodic Maintenance
No periodic maintenance is required.
1.6.1.3 Repair & Calibration
Require equipment and spare modules or components as specified as followings.
(1) MAIN ASSY P/N 55.71M01.001

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(2) VIDEO ASSY P/N 55.71M02.001
(3) USB ASSY P/N (OTPIONAL) 55.74506.001

1.6.2 Mean Time to Repair

1.6.2.1 Module Level
Less than 10 minutes
1.6.2.2 Component Level
Less than 15 minutes

1.6.3 Accessibility

1.6.3.1 General
All panels, covers, and major assemblies are removable without disruption of permanent mounting or fasteners
1.6.3.2 Outside Cabinet, access to the following elements
-Operating Controls: see section 4-3
-Power Connectors: see section 3-2
1.6.3.3 Cover Removal, Access
ALL sub assemblies and internally adjustable components may be accessed by removing the bucket and the bezel together.

1. 6.4 Equipment & Tools Required

1.6.4.1 Standard Test Equipment
(1) Voltmeter
(2) Dual trace oscilloscope
(3) High voltage probe
(4) Hand tools required
(5) Color analyzer, Minolta CA-100 or equivalent.
(6) Pattern Generator CHROMA-2250
1.6.4.2 Documentation
A service manual will be available which covers all service requirements , A users manual written in German, Italian , and English will be available to ship with the product.

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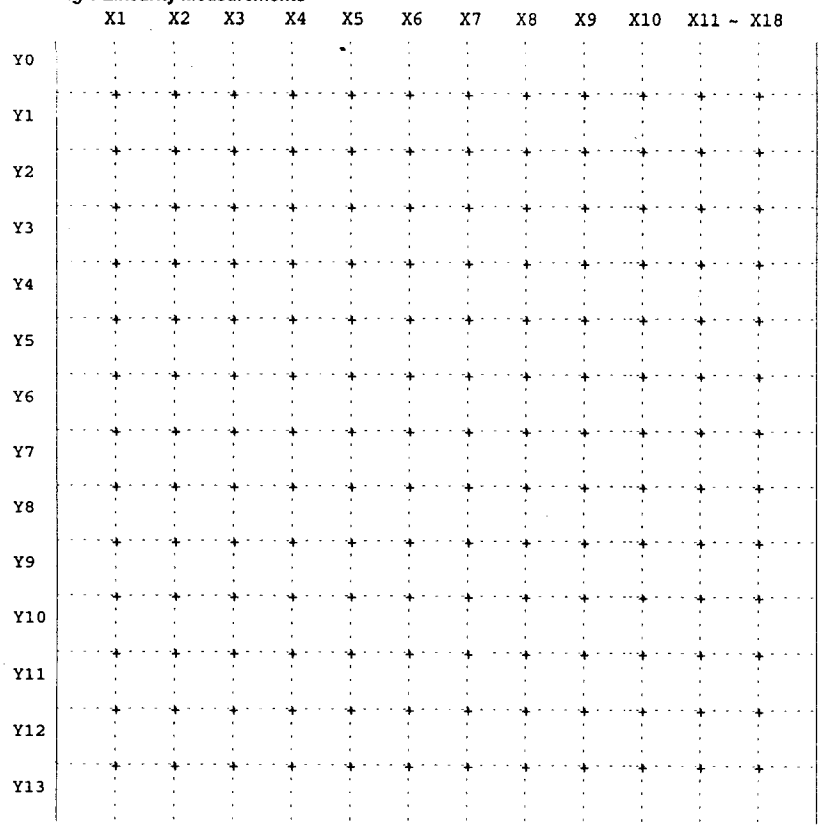
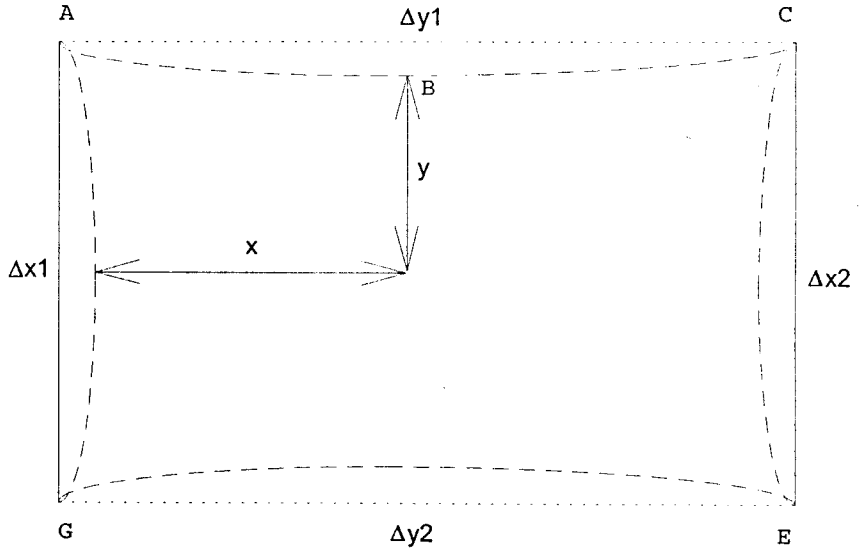
Fig 1 Linearity Measurements



$$\frac{Xmax - Xmin}{Xmax + Xmin} \times 100\% < 5\%$$

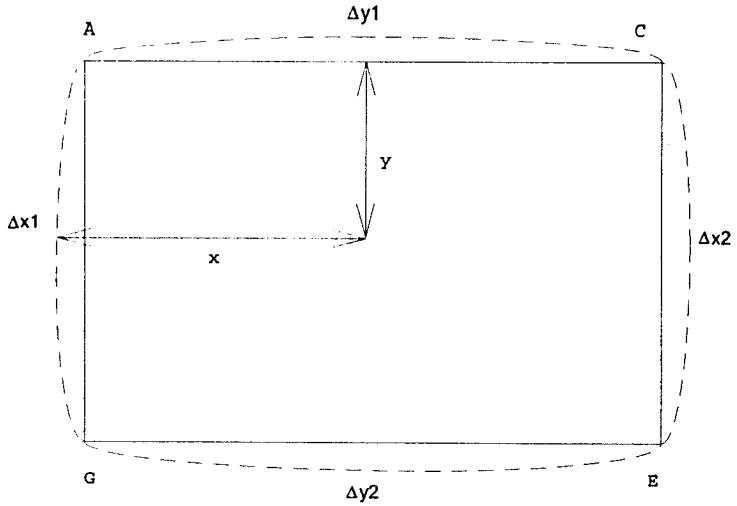
$$\frac{Ymax - Ymin}{Ymax + Ymin} \times 100\% < 5\%$$

Fig.2 Pincushion Measurements



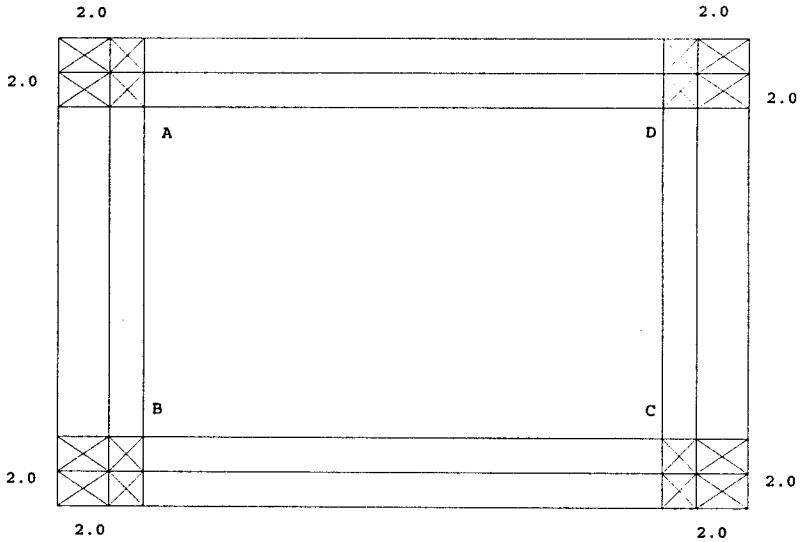
→ [AC+EG]/2, [AG+CE]/2 represented as display area width and
→ height
→ Top/Bottom Pincushion = y1 or y2
→ Side Pincushion = x1 or x2
→ Linearity (TCO99) = x1/x or y1/y

Fig.3 Barreling Measurements



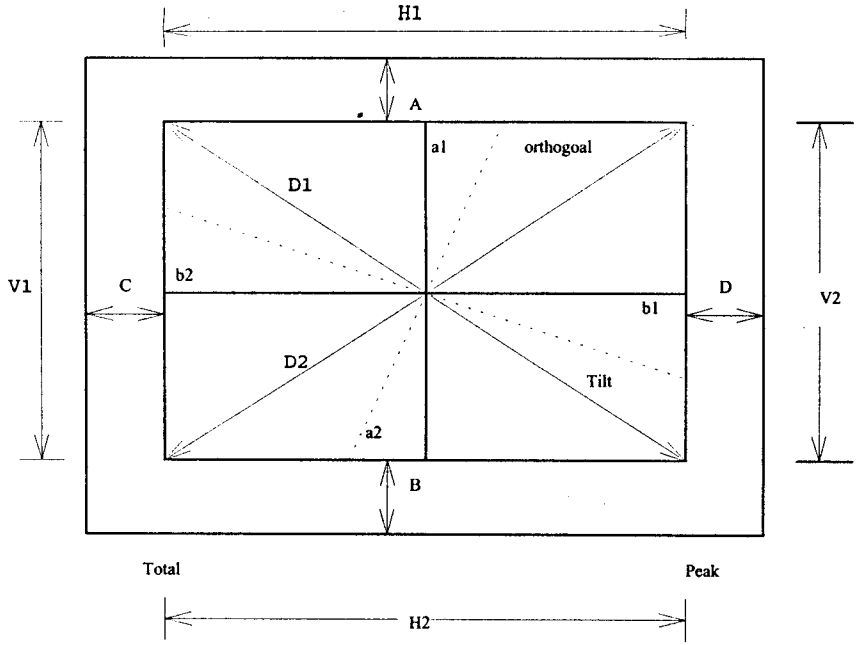
[AC+EG]/2, [AG+CE]/2 represented as display area width and height
Top/Bottom Pincushion = Δy1 or Δy2
Side Pincushion = Δx1 or Δx2
Linearity (TCO99) = Δx1/x or Δy1/y

Fig.4 Trapezoid Measurements



* Each of the 4 corners of picture shall fall within the relevant area (F) illustrated up (hatched)
* ABCD is the picture outlines.

Fig. 5 Picture Distortion & Phase Measurements



→ V (Cent) = |A-B| < 6mm
→ H (Cent) = |C-D| < 6mm

→ Orthogonality (TCO99) : $\frac{|H1-H2|}{0.5(H1+H2)} \le 0.02, \frac{|V1-V2|}{0.5(V1+V2)} \le 0.02, \frac{|D1-D2|}{0.5(D1+D2)} \le 0.03,$

Fig. 6 Physical Distortion, Front

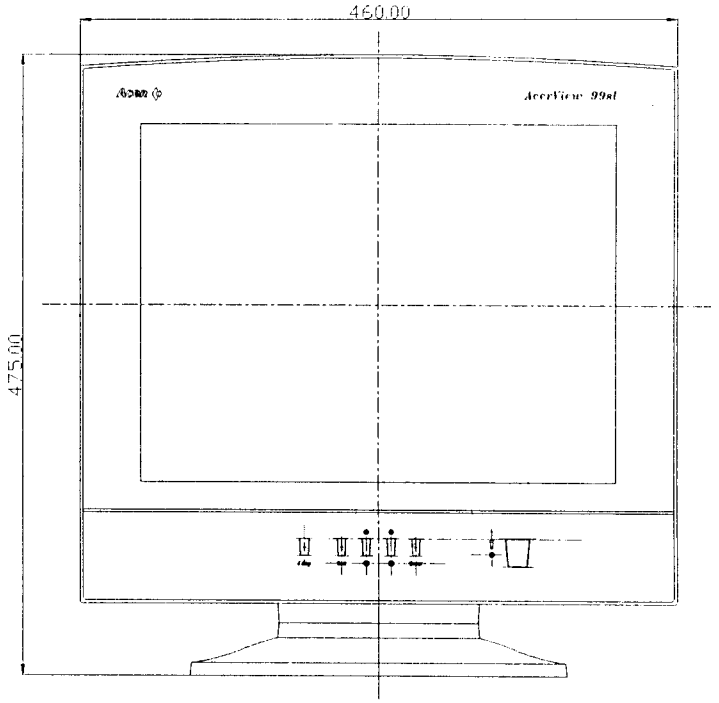


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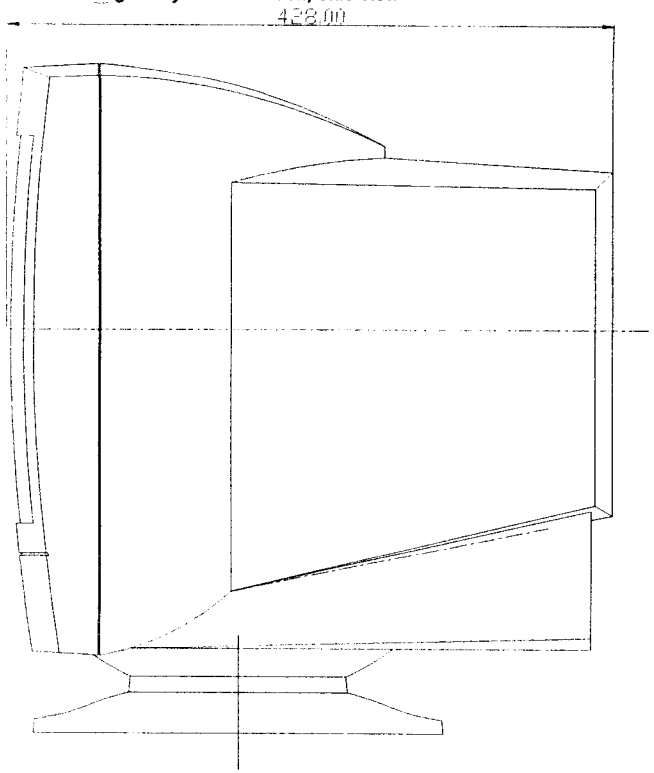
Fig. 7 Physical Distortion, Side View



Chapter 2

CRICUIT OPERATION THEORY

2.1 Deflection CKT

2.1.1 99sl System Block Diagram

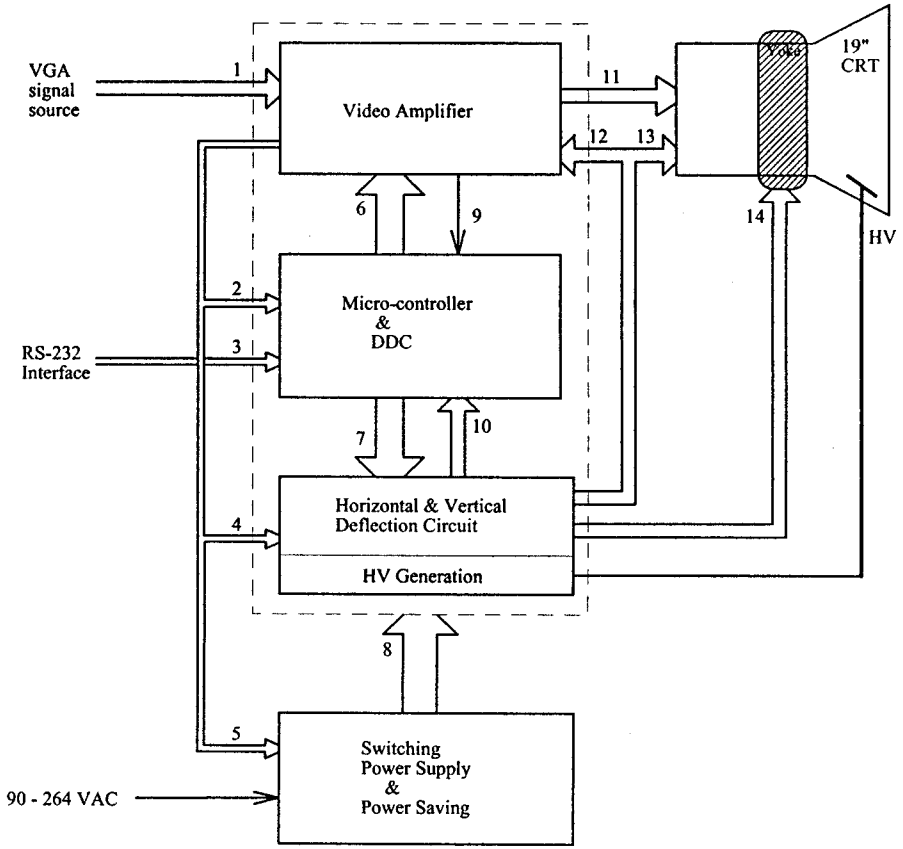


FIGURE.1 99sl System Block Diagram

2.1.2 Deflection and HV generation circuit introduction

2.1.2.1 Deflection and HV generation circuit block diagram

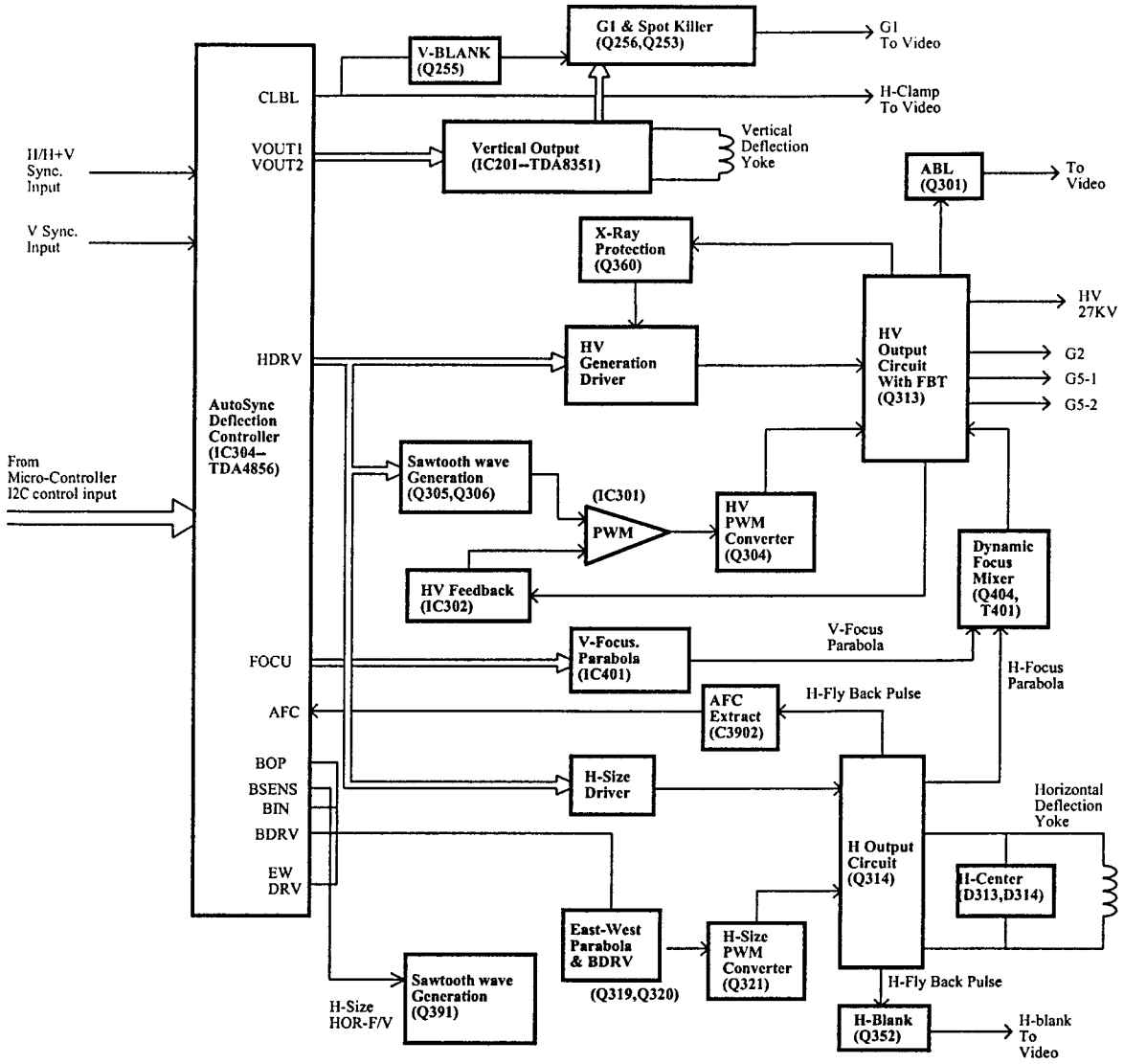


Figure 3: 99sl function block of deflection output circuit

2.1.3 Internal Function Block Diagram of The Autosync Deflection Controller TDA4856

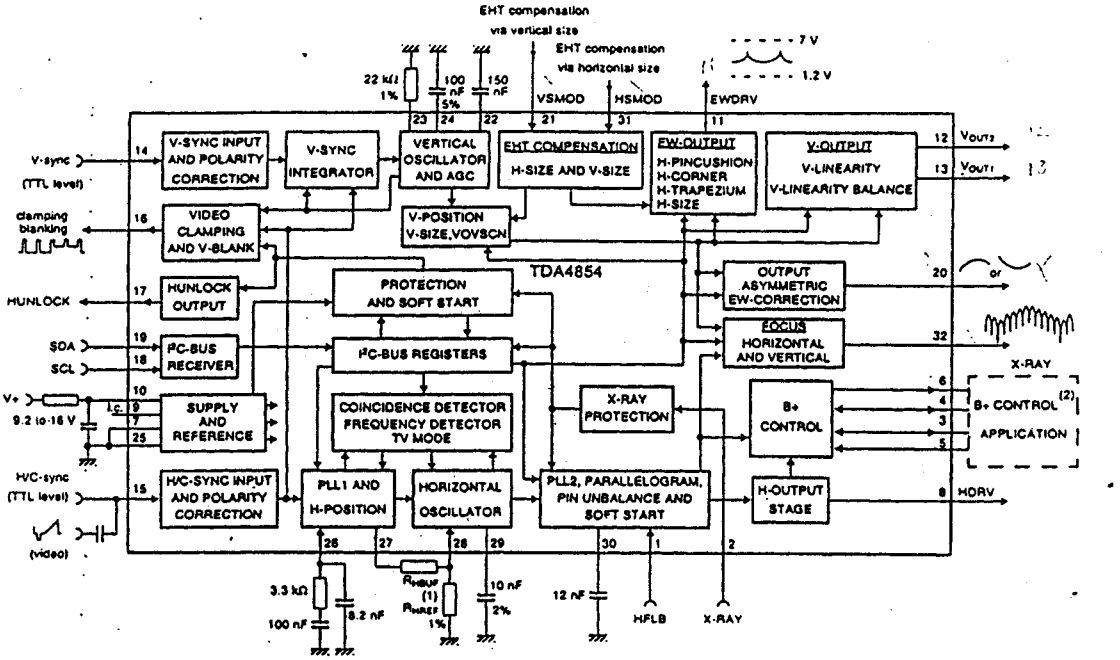


FIGURE.4 Internal Function Block Diagram of The Autosync Deflection controller TDA4856

TDA4856 is a high performance and efficient solution for autosync monitors. AS FIGURE.4 All functions are controllable by I2C-bus.

TDA4856 provides synchronization processing, horizontal and vertical synchronization with full autosync capability, a TV/VCR mode and very short settling times after mode changes. External power components are given a great deal of protection. The IC generates the drive waveforms for DC-coupled vertical boosters such as TDA486X and TDA8351.

TDA4856 provides extended functions e.g. as a flexible B+ control, an extensive set of geometry control facilities, and an combined output for horizontal and vertical focus signals.

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2.1.4. 99sl Autosync Deflection Controller circuit

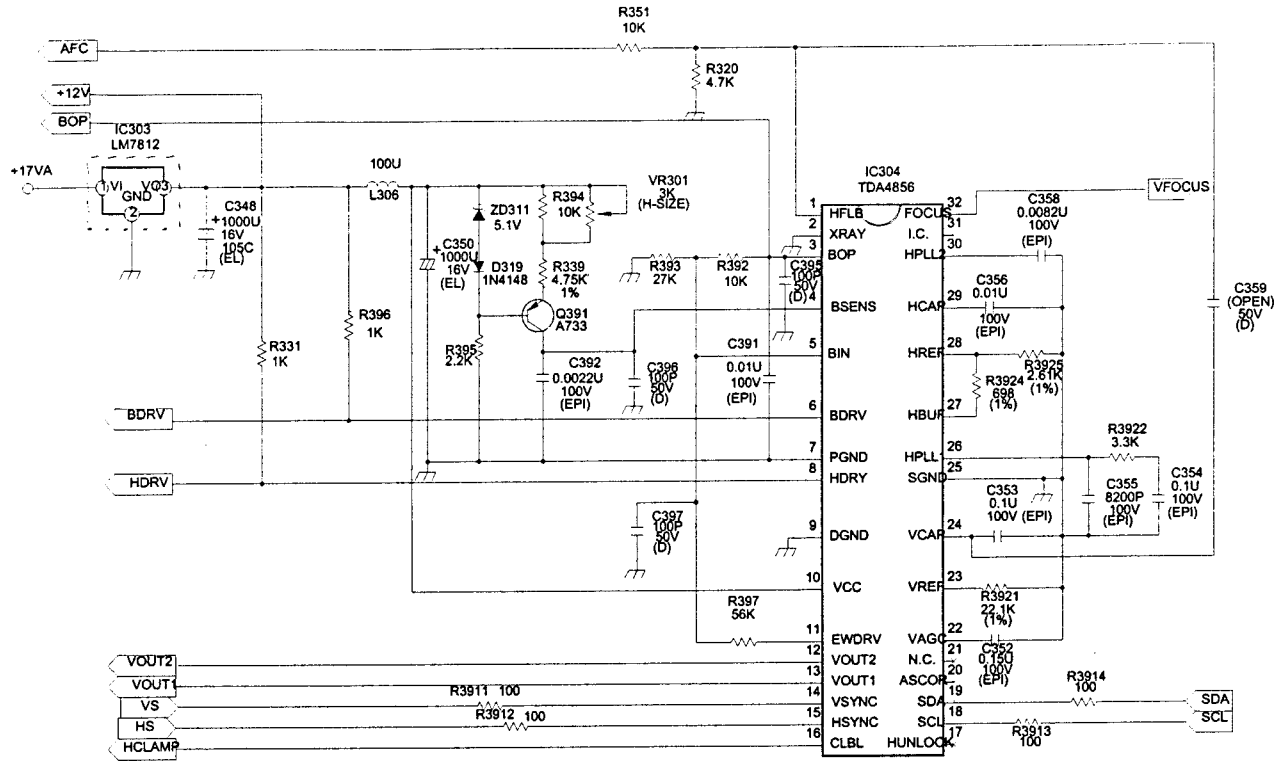

FIGURE.5 99sl Autosync Deflection Controller circuit

The autosync deflection controller circuit is shown in FIGURE.5. R3924 and R3925 is set fhmax and fhmin of the horizontal oscillator, which make 99sl monitor that have 28.5KHz free run mode and horizontal hold frequency range are from 30KHz to 98KHz.

2.1.5 99sl Vertical Output Circuit

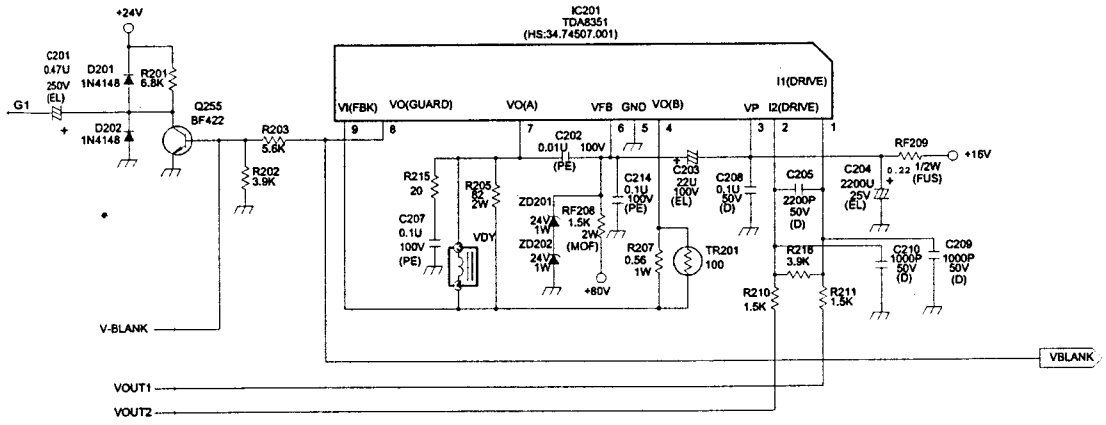

FIGURE.6 99sl Vertical Output Circuit

TDA8351 vertical deflection booster is proper for TDA4854 autosync deflection IC. This vertical output circuit is shown in FIGURE.6. This vertical driver IC circuit is a bridge configuration. From TDA4854 differential output signal V-OUT1 and V-OUT2 connected to TDA8351 pin1 and pin2 via DC-couple. The vertical deflection coil is connected between the output amplifier (pin4 and pin7), which are driven in opposite phase. The TDA8351 can output current 2.8Ap-p maximum to drive V-DY(Vertical Deflection Yoke). It can be calculated by:

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I_{R216}*R216=I_{coil}*R207

So we can easy to control I_{coil} by R216 and R207. Furthermore VO(GAUARD) at pin8 is used for vertical blanking the picture tube screen. TR201 is compensate temperature effect for V-size.

V-blanking signal is taken from IC201 pin 8 and inverted by Q201 to get a 24 Vp-p negative pulse, then, the negative V-blanking signal is sent to G1 grid via C201 to cancel the vertical retrace line of raster.

2.1.6 99sl Spot killer and G1 circuit

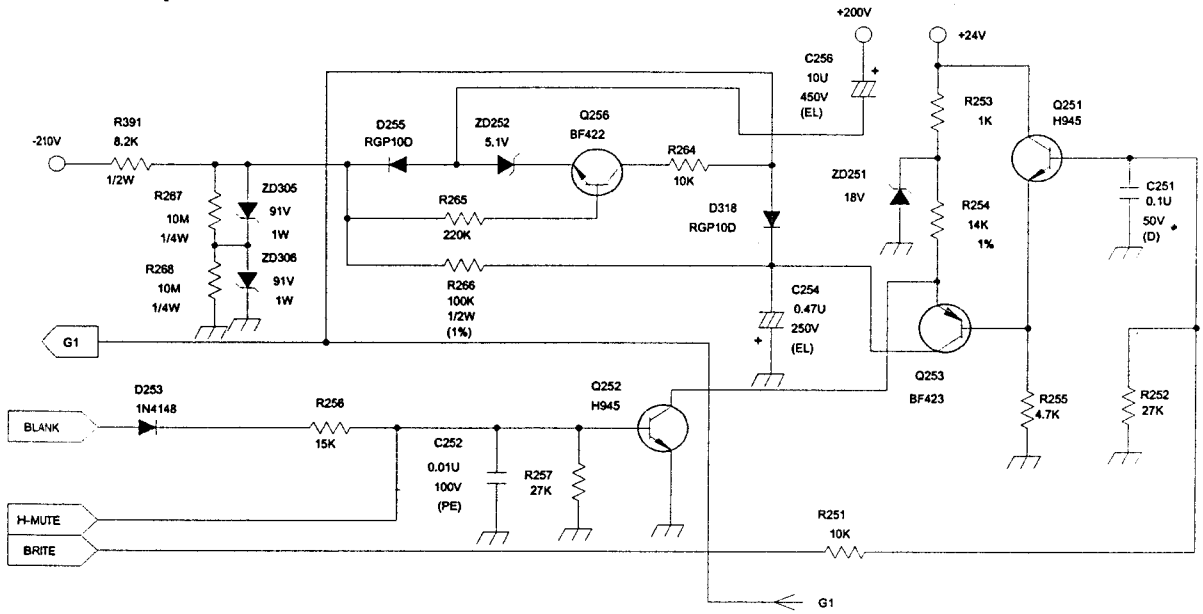

FIGURE.7 99sl Spot killer and G1 circuit

When the monitor turn off power, Horizontal and vertical defection will be stop fast, but monitor will have light spot appear in screen which will destroy CRT at center screen, so monitor need spot killer circuit to prevent this light spot. The spot killer circuit show in FIGURE.7 is used to pull more down G1 voltage and make picture disappear quickly. Also when another function need blank screen and they can easy to use this circuit function, and to perform picture blanking action.

G1 voltage level is decided by BRITE from micro-controller DC control voltage. User can adjust brightness from front panel directly, Q253 common emitter voltage amplifier which output G1 negative voltage.

When 99sl monitor turns off, because +200V will discharge to 0V that is faster than -210V, so it makes Q256 ON and pull low G1 to about -182V. Thus, G1 makes a barrier for CRT cathode signal, and to prevent spot to destroy CRT.

2.1.7 Tilt

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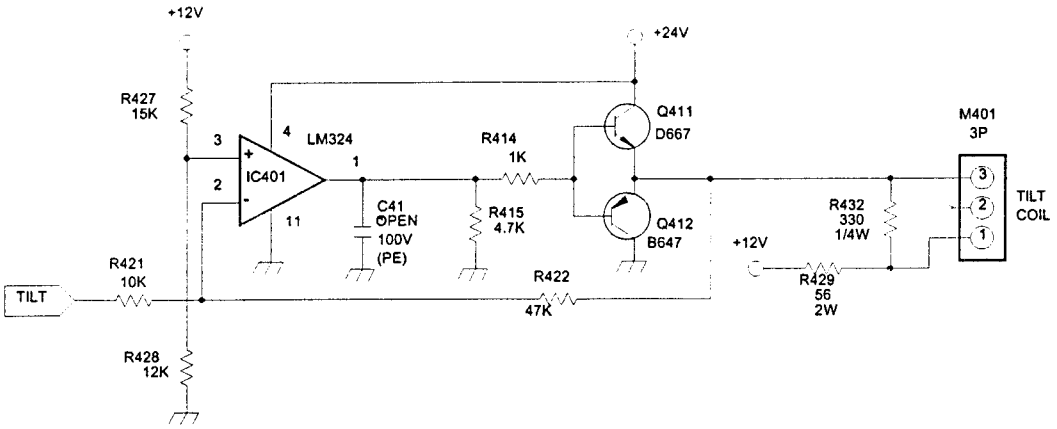

Fig8: Tilt circuit

IC401 LM324 is offered for voltage amplifier to supply 0 ~ 24 at op-amp output terminal The amplifier signal is input to tilt coil via Q411,Q412 current amplifier to get positive and negative coil current for tilt , adjustment.

2.1.8 Horizontal Size Processing Circuit

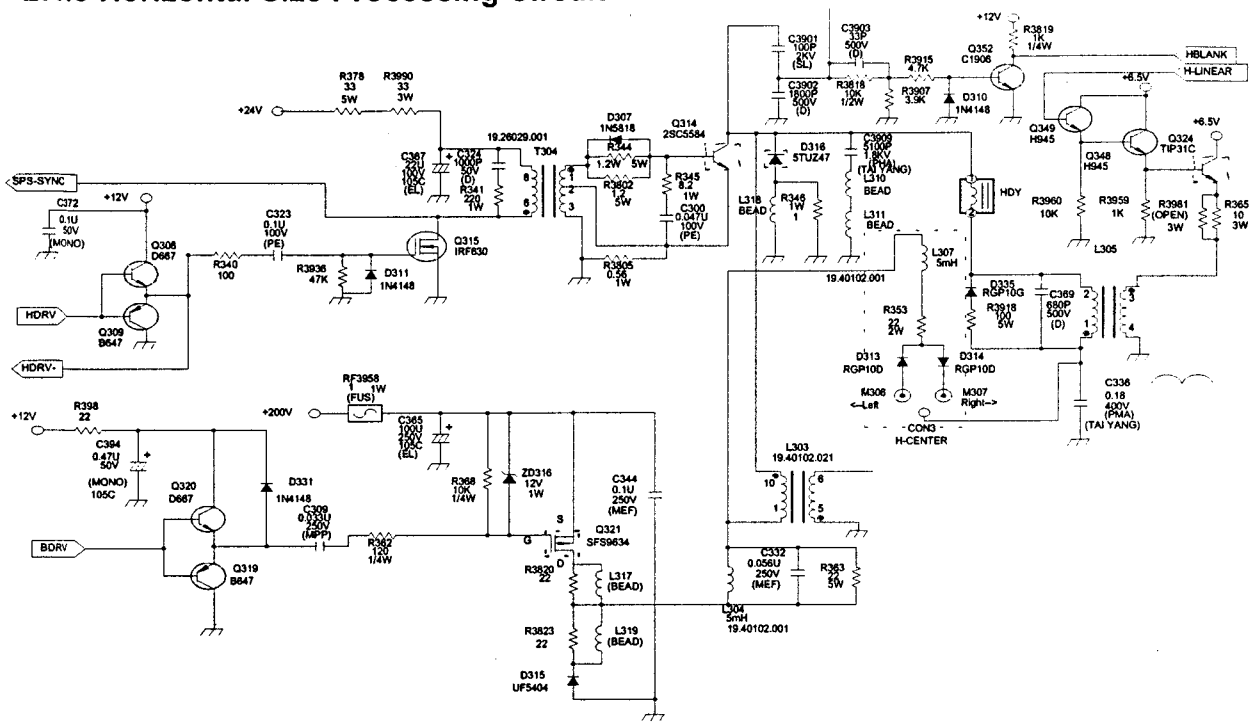

FIGURE.9 H-size drive & Hor. PWM Circuit

2.1.9 sawtooth waveform generator

IC304 pin 3,4,5 connect with Q391 to constitute a sawtooth waveform generator.(FIG.10)

H-size is controlled directly through HDRV by I2C. VR301 is preset H-size control in order that factory can adjust H-size just overscan at 31KHz mode and overscan at every modes.

In order to assure every modes from 31k to 98kHz overscan, a H-size control signal is fed to pin4 of IC304 and make every modes overscan fully. Finally, the sawtooth waveform is fed to pin11 of IC304 PWM compactor.

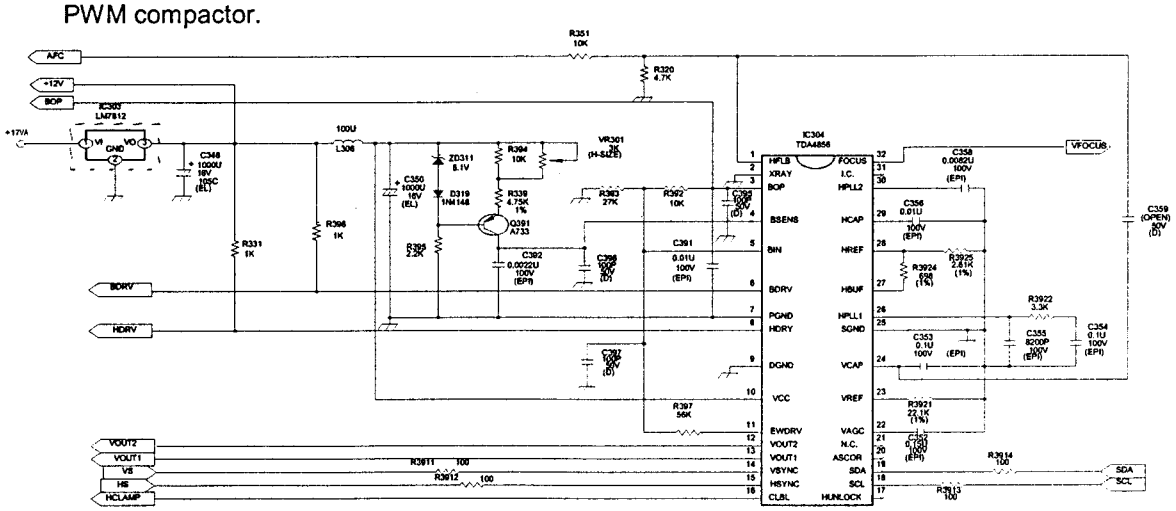

FIGURE.10 Sawtooth Wave Generation & East-west Parabola mix Circuit

2.1.10 East-west parabola driver

The east-west parabola signal is come from IC304(TDA4854) pin11 and east-west parabola signal to get correct polarity.

The east-west parabola signal input to IC304 pin5 BIN comparator and compensates pincushion distortion of picture. and output from IC304 pin 6 BDRV . Q336, D330, R3815, R3814, Q373, Q354, D353, D363, D312,R359, C329 constitute two stages protect soft start circuit to protect Q314 from surge voltage when monitor power on.

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2.1.11 H-size PWM Converter

IC304 constitutes a PWM comparator to compare east-west parabola signal with sawtooth waveform signal and output a PWM pulse at pin6 of IC304 .

What is PWM ? PWM means pulse width modulation. Basically PWM function needs two signal : one is modulation signal (high frequency), another is modulated signal (low frequency). Thus, east-west parabola signal is modulated by sawtooth signal. After modulation, the PWM pulse is input to Q321 (PWM converter) via Q319, Q320 drive circuit.

2.1.12 H-size output circuit

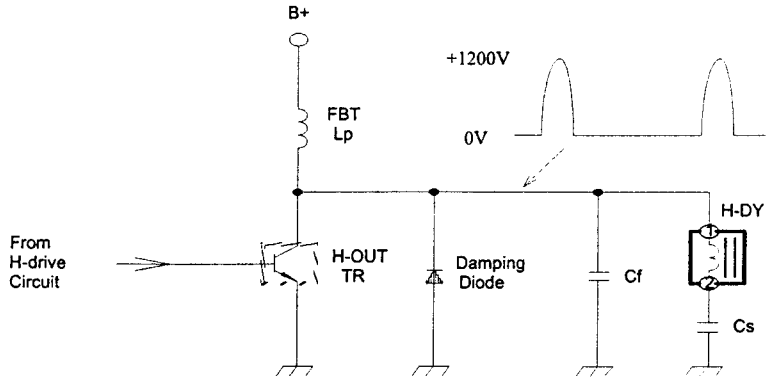

FIGURE.11 Conventional H-size output circuit

- Conventional H-output circuit has a positive " collector pulse" from 0V up to 1200V.
- Q321 forms PWM converter to accept PWM pulse and vary Q321 On/Off duty.

2.1.13 Top ringing eliminated circuit

L304, R363, C332 constitutes top ringing eliminated circuit to reduce ringing at top of picture.

2.1.14 H driver circuit

HDRV signal is come from IC304 pin7 and is driverd by Q308 and Q309, then goes into Q315 gate terminate. Q315 constitutes an inverting stage and combines with T304 to form H-size drive circuit which drives Q314.

R341 and C324 constitutes a snubber circuit to decrease the voltage at Vds of Q315, R344, R3802, R345 and D307 set optimum base current of Q314 to get lowest power consumption. T304 is proportional drive transformer which offers adequate base current of Q314 from low frequency mode to high frequency mode.

2.1.15 Cs capacitor control circuit

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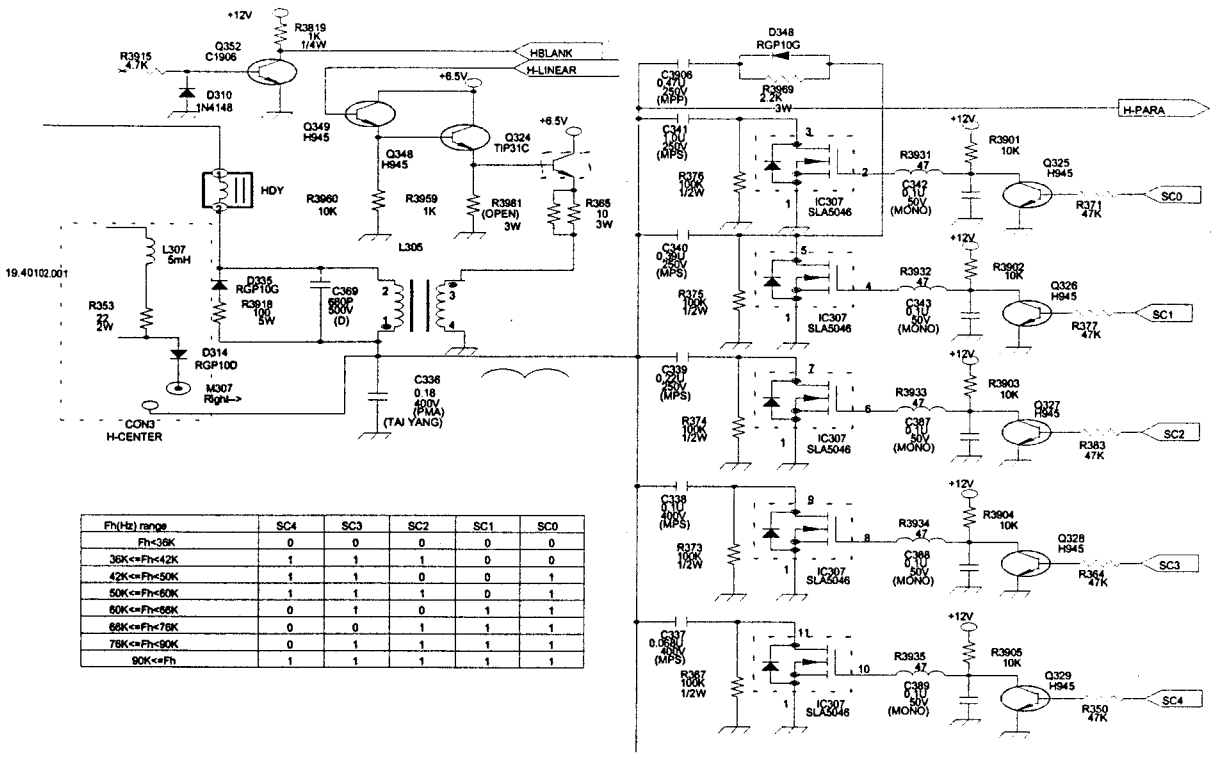

Fh(Hz) range	SC4	SC3	SC2	SC1	SC0
Fh<36K	0	0	0	0	0
36K<=Fh<42K	1	1	1	0	0
42K<=Fh<50K	1	1	0	0	1
50K<=Fh<60K	1	1	1	0	1
60K<=Fh<68K	0	1	0	1	1
68K<=Fh<78K	0	0	1	1	1
78K<=Fh<90K	0	1	1	1	1
90K<=Fh	1	1	1	1	1

FIGRE.12 Cs capacitor control circuit

This monitor needs several Cs capacitors to obtain good linearity picture from 31kHz to 98kHz modes. Cs capacitors includeC337, C338, C339, C340, and C341 is always on in every modes.

C337, C338, C339, C340 and C341 are switched by IC307 and switch control signal are sent from UC IC801. The switch truth table is as follows :

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2.1.16 H-linearity control circuit

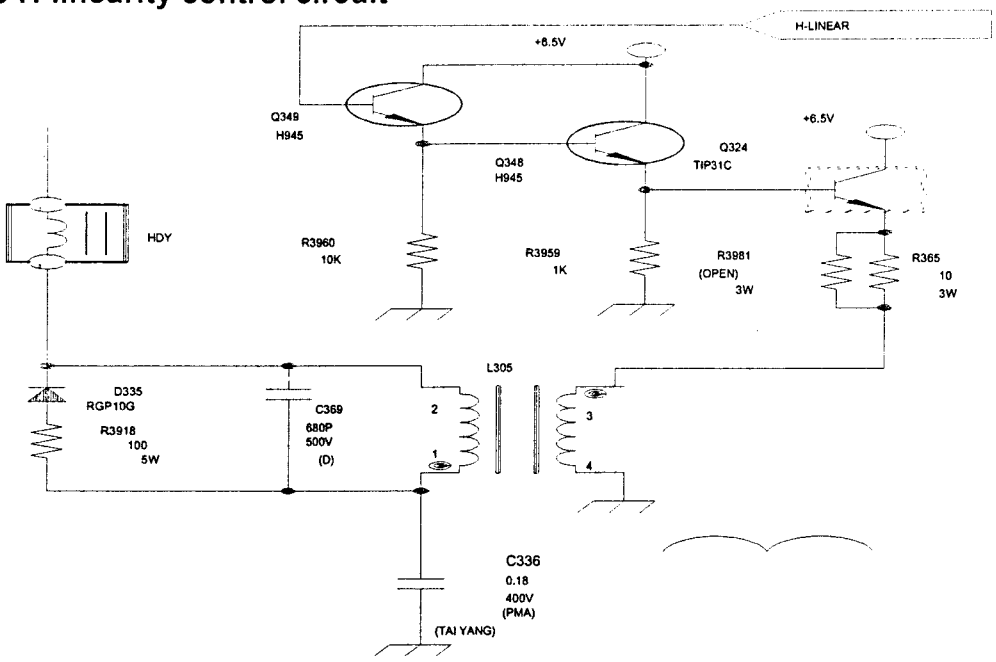

FIGURE.13 H-linearity control circuit

This monitor use a special linearity coil to get good linearity picture from 31kHz to 98kHz modes.

For the purpose of getting a DC control voltage from IC801 pin 28 H-Linear , and buffered by Q349, Q348.The DC control voltage proportional to different frequency. Thus we use the DC voltage and control Q324 Ie current in order to get excellent linearity from 31kHz to 95kHz modes. R3918 and C369 constitutes left ringing bar eliminated circuit to make left picture ringing bar disappear.

2.1.17 H-center circuit

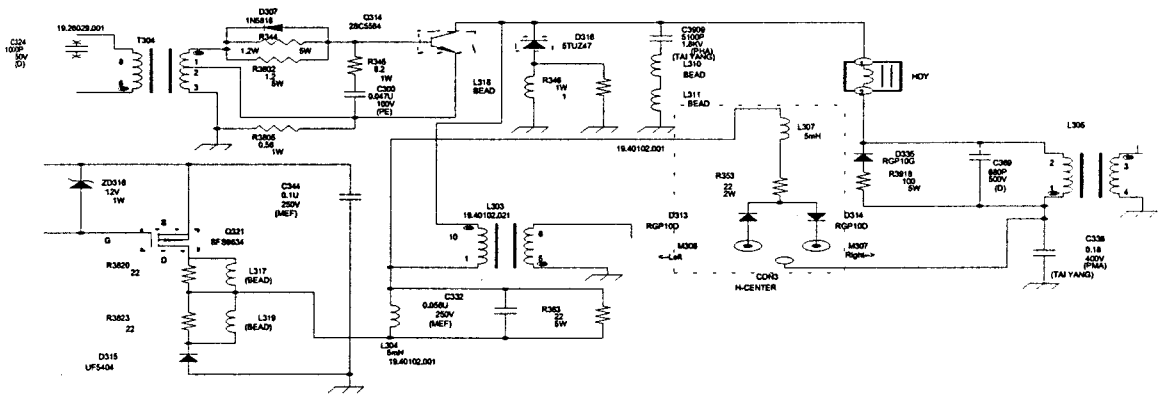

FIGURE.14 H-center circuit

L307, R353, D313, D314 constitutes H-center control circuit. When CON3 connect to M306 , M307 for adjustment raster left and right , so H-DY current can be control in order to change raster horizontal position in the center of screen.

2.1.18 Hor. spot protective circuit

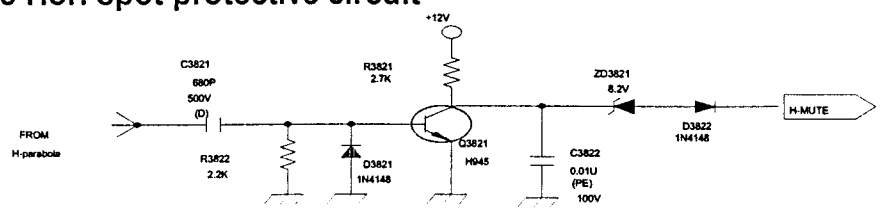

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FIGURE.15 Hor. spot protective circuit

During to using separated H-output circuit, if H-size output circuit is damaged but high voltage output circuit still activates, then, CRT phosphor may be damaged owing to horizontal scan stop.

Q3821 constitutes Hor. spot protected circuit. In normal operation, Q3821 is on and the Vce of Q3821 never over 6.8V zener voltage of ZD3821. When H-size output circuit stops, there is no Hor. pulse input base of Q3821. So Q3821 is off and ZD3821 is on to make blank circuit Q252 on and G1 voltage of CRT become very negative. Picture is blanked, so spot is eliminated.

2.1.19 High Voltage Processing Circuit

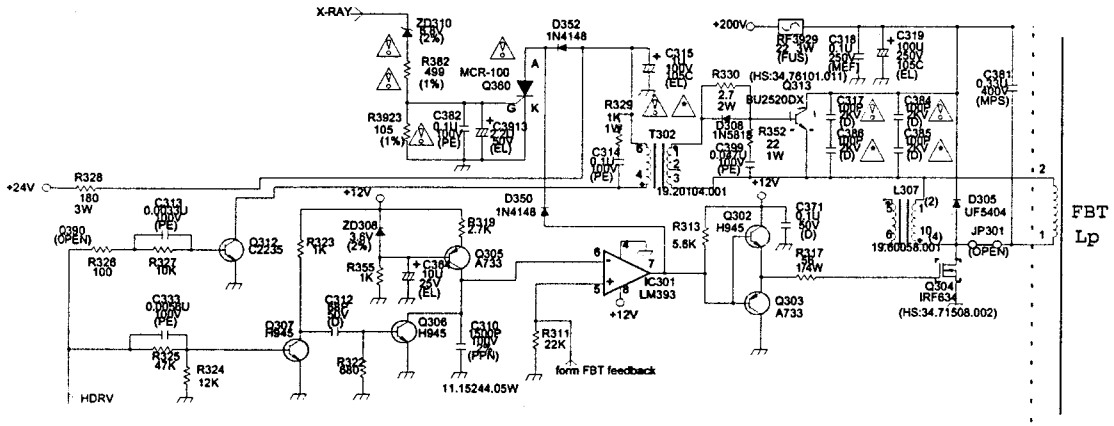

FIGURE.16 High Voltage Processing Circuit

High voltage output circuit also use negative pulse circuit owing to excellent high voltage regulation effect. Other circuits are the same as H-size processing circuit.

2.1.20 Sawtooth waveform generator

Q305, Q306, C310 constitutes sawtooth generator and input sawtooth signal to IC301 pin6 PWM comparator.

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2.1.21 High voltage feedback compensation circuit

For the purpose of getting accurate CRT anode voltage 26kV in different modes and different patterns, high voltage feedback compensation circuit is very important. IC302 functions as a integrator which offer frequency compensation. R309, C307, C325 are frequency compensation elements which make voltage regulation excellent. VR302 is offered to adjust correct anode voltage by factory.

R314, C308, D319 constitutes soft start circuit to assure high voltage up to setting value gradually when power on, in order to protect high voltage transistor Q313.

The feedback compensation signal is taken from FBT inside bleed and capacitor and input to IC302 pin6.

The processed feedback compensation signal is fed to PWM comparator IC301 pin5 and compares with sawtooth signal at pin6 of IC301 to output PWM pulse at pin7 of IC301. The PWM pulse is buffered by Q302, Q323 and drives Q304 high voltage converter.

2.1.22 High voltage output circuit

In fig.8, we can find there is no H-DY and Cs capacitor, only FBT Lp and C317, C386, C384, C386 are exist. The negative pulse at emitter of Q313 is resonant by C317, C384, C385, C386 and FBT Lp and the pulse width TR of negative pulse is

$$t_r = \pi\sqrt{L_p * (C317 // C386 + C384 // C385)} \approx 3us$$

The emitter voltage Q313 is about -700Vpeak and subject to change with different patterns and different modes.

Q312 and T302 constitutes high voltage drive circuit to offer optimum base current of Q313.

2.1.23 X-ray protective circuit

Q360(SCR) constitutes X-ray protection. If in abnormal condition, high voltage go rise to over 28.5kV, then the voltage at R342 go up to turn on ZD310 and Q360. So Q312 is off and Q313 is also off.

2.1.24 ABL circuit

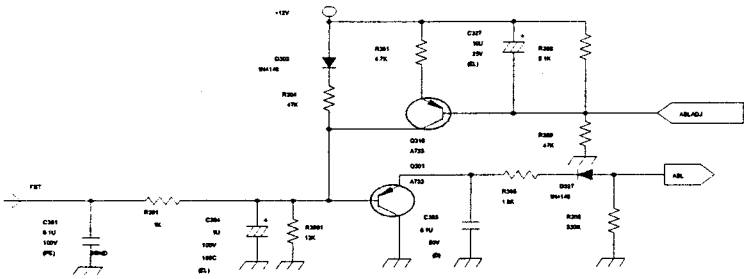

FIGURE.16 ABL circuit

Q301 constitutes ABL circuit and VR301 is offered for factory setting to adjust picture luminance about 30Ft-L at full white pattern. When picture become bright, the voltage of Q301 base will decrease, then the contrast voltage also decrease, so get automatic brightness limit function.

2.1.25 Dynamic Focus Circuit

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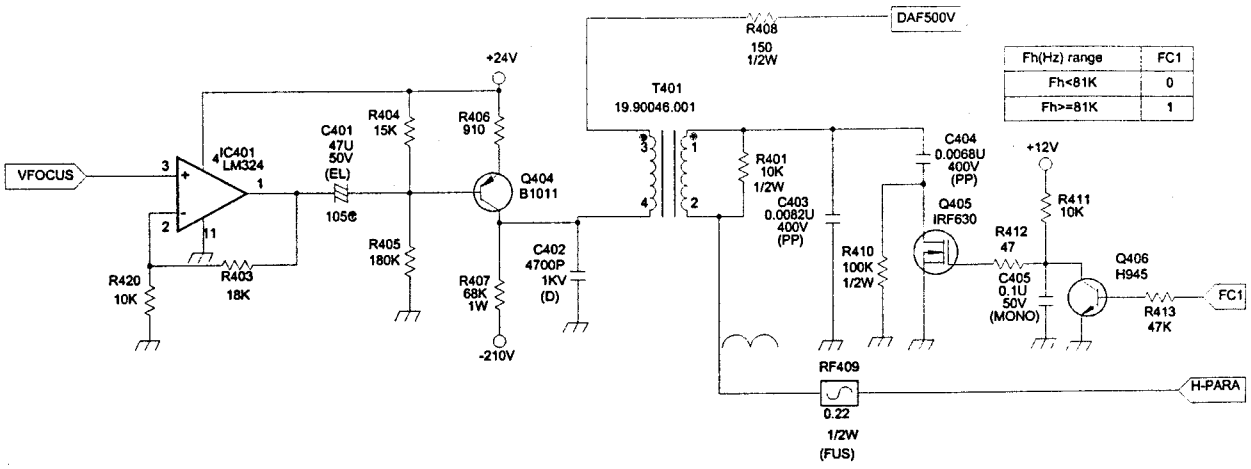

FIGURE.17 Dynamic Focus Circuit

2.1.26 Vertical focus circuit

This monitor use double focus CRT, so it needs vertical and horizontal parabola focus signal to input CRT G3 and G5 grid.

The vertical parabola signal is gotten from IC304 pin32 , and amplitued by IC308 and Q404 to obtain about 200Vpp at the collector of Q404 , via T401 mixed with horizontal signal input FBT focus pack.

2.1.27 Horizontal focus circuit

The horizontal parabola signal is taken from Cs capacitor and amplified by T401 to acquire about 390Vpp amplitude at pin3 of T401 to combine with vertical parabola signal and input FBT focus pack.

2.2 Microcontroller Cricuit Operation

2.2.1Introduction

This model, 7299sl, will support powerful OSD function to help end user fine adjustment. The Microcontroller circuit of the 7299sl can determine what mode it is by detecting the frequency of horizontal and vertical synchronous and the polarity of horizontal synchronous, and provide DC voltages to control the picture and save the adjusted value into the EEPROM by using the OSD, "On Screen Display control", that means the user can get any information of the picture display or adjust it and save the status values into the EEPROM by choosing and pressing the proper key according to the indication of the OSD. In addition, user can press i-key to do auto-calibration.

2.2.2 Block diagram

The major parts of 7299sl Microcontroller circuit are MCU, EEPROM, OSD IC, and Auto Calibration Module. The circuit block diagram is shown as below.

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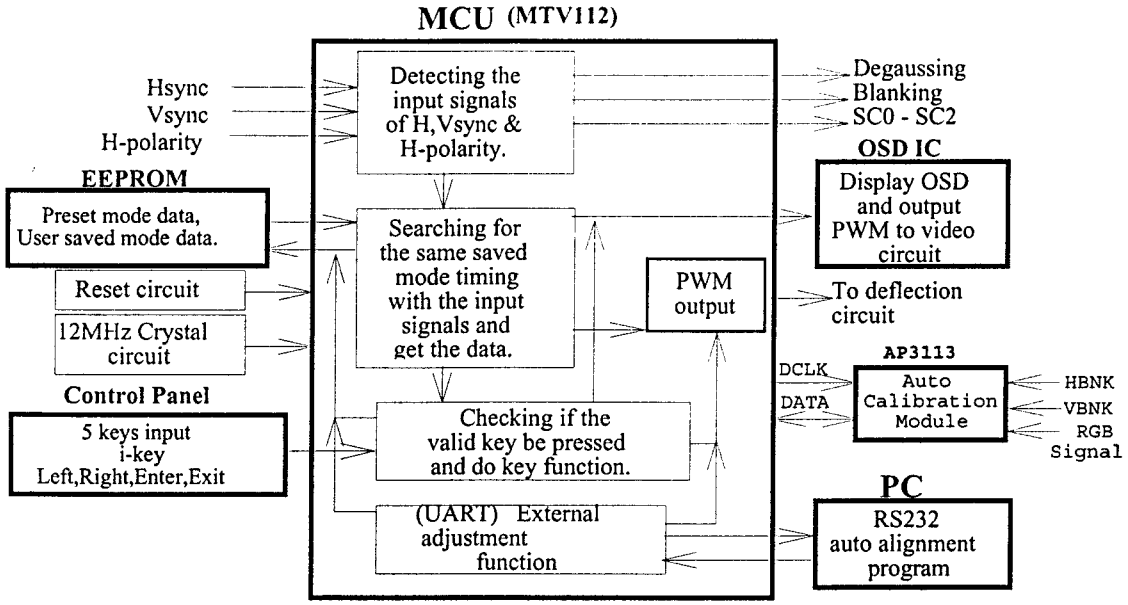

2.2.3 MCU and the peripheral circuit operation theory

2.2.3.1 MCU function

The MCU is MTV112, it is an 87C51 with PWM output controlled microcontroller, after power on,the reset circuit output a "High" to "Low" signal(>40mS) and the 12MHz crystal oscillated circuit working , the MCU begin to manages the following functions,

(1) To detect mode and output proper SC0, SC1 and SC2 to deflection circuit.

(3) To check if there is the same saved mode in the EEPROM and get the data to transfer into DC voltages by PWM output and RC filter circuits to control the picture, color, contrast and brightness.

(3) To check if there is the valid key be pressed and do the key function.

(4) To memorize mode timings and any adjustable parameters of the picture into EEPROM.

(5) To output data to OSD IC for making an "on screen display control" menu.

(6) The inner registers and PWM output of MCU can be controlled by the external PC alignment program.

(7) To calibrate the size, position, and geometry of the picture by pressing i-key. It will be placed right size and position.

2.2.3.2 How to detect mode timing

Only when the mode timing input is stable, we can adjust the picture and check the horizontal and vertical sync frequency by the OSD menu, and the mode timing input mean the horizontal sync signal and the vertical sync signal.

(1) The vertical sync frequency measurement:

We use the base timer, it can generate a count during a fixed time, this fixed time is 12/12MHz and we call it "Time_base", so when the first vertical sync generated, we enable the base timer,and the next vertical sync generated,we disable the base timer,and we only need to calculate how many counts are during a vertical sync period. The formula is

Vertical sync frequency

= FV

= 1 / Vertical sync period

= 1 / [Counts * (Time_base)]

==> **Vertical sync frequency = 1000000 / Counts**

(2) The horizontal sync frequency measurement:

We use the event counter for calculating how many counts are during a long fixed time, because the vertical sync period is longer than the horizontal sync period, we can enable the event counter when the first vertical sync generated and disable the event counter when the next vertical sync generated, this time,we can get the horizontal sync counts during a vertical sync period.

The formula is Horizontal sync frequency

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= FH
= Horizontal sync counts / Vertical sync period
==> **Horizontal sync frequency**
= Horizontal sync Counts / Vertical sync period

2.2.3.3 What are the valid key functions for user

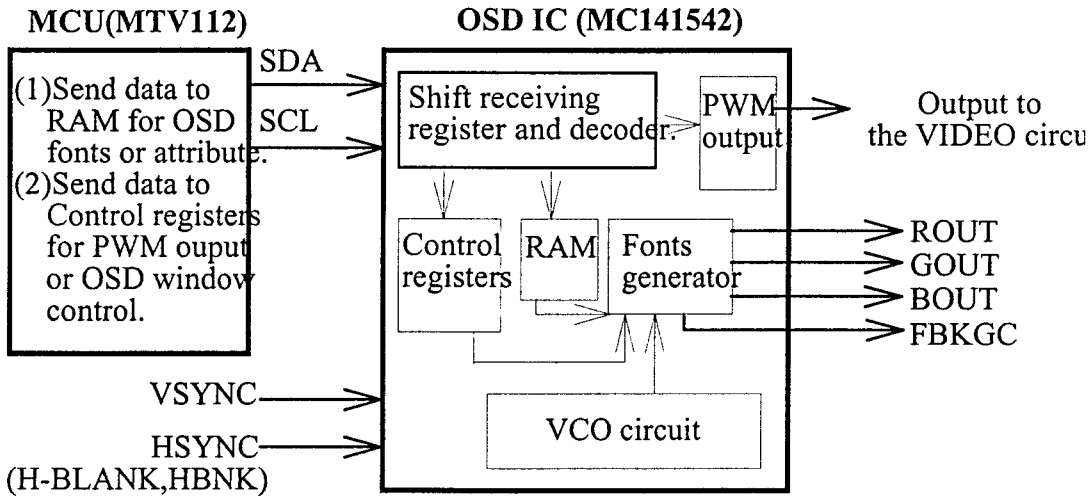
There are Five keys on 7299sl control panel. They are "i-key, "Left," "Right," "Enter," and "Exit." The one, i-key, is for auto calibration function, the others are used for OSD controlling. "Enter" for entering sub-menu of main menu, "Exit" for escaping to main menu from sub-menu or leaving OSD menu, and "Left," "Right" for adjusting the bar value.
Except the OSD basic key functions, the user can only press "Right" for brightness adjustment, or "Left" for contrast adjustment.

2.2.3.4 How to memorize the timing and adjusted data

The EEPROM of 7299sl is 24C08, it has 1024 bytes memory size and communicates with MCU by two wires of I^2C bus, one wire is "SCL," the other is "SDA".
The MCU send clock and data to EEPROM to do "Write" function and send clock and receive data from EEPROM to do "Read" function by these two wires.
We define three parts of storage area. One is for the storage of the factory preset data, another is for saving user adjusted data, the other is for common settings area where stored the data of the OSD color temperature settings, contrast and brightness value .

2.2.3.5 How to display the OSD menu

The OSD IC of 7299sl is MC141542 which is developed by vender, it receives the data of the OSD fonts and attribute what we want to display on the screen from the MCU by 2 wires of communication, and exports OSD window data and PWM volume to the VIDEO circuit, the block diagram is shown as below,



2.2.3.6 How to execute the auto alignment function:

The MCU MTV112 supports the UART function, it has 2 I/O serious ports, one is the receiver, the other is the transmitter, they are connected with an interface to PC and PC can execute alignment program by RS232 communication to send the formatted data to the MCU for adjusting any adjustable parameters of the picture and saving the adjusted values into EEPROM. By this way, we can get the products with the same quality and reduce the manufacturing time.

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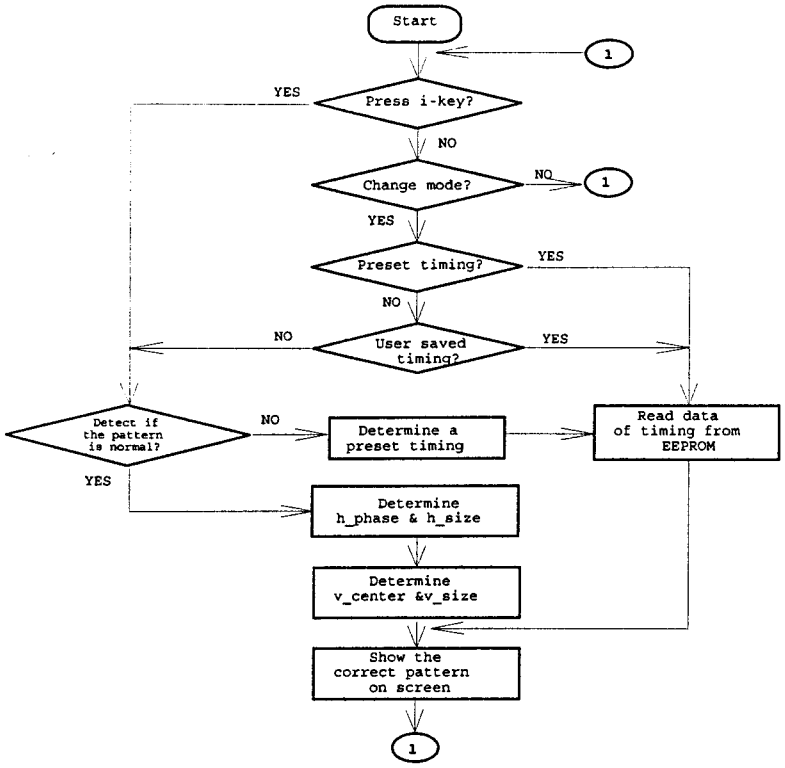
2.2.3.7 Flowchart for Auto



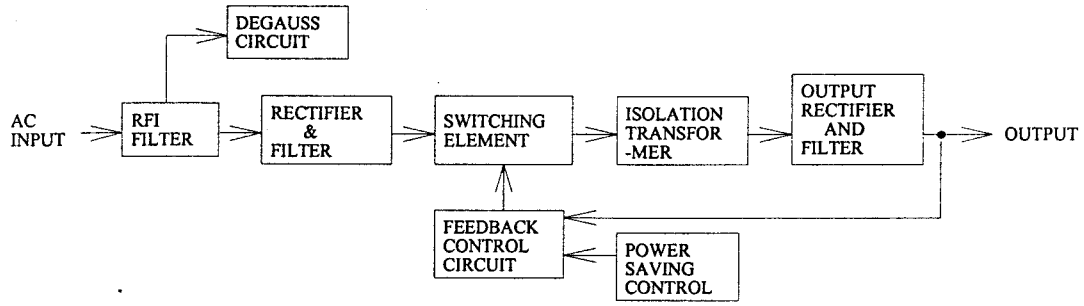
2.3 Switching Power Supply Operation Theory

2.3.1. General Specification

Input Voltage : 90~264VAC (UNIVERSAL)
Input Frequency : 47~63Hz
Output Requirement:

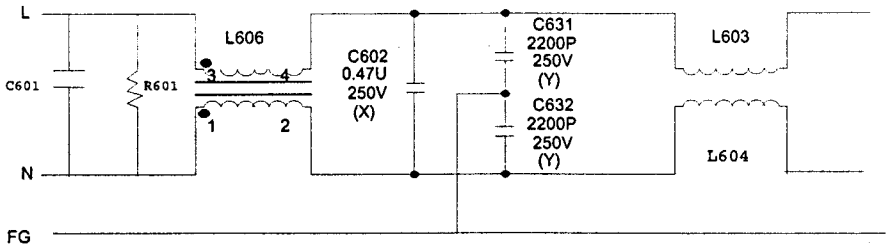
Output	MAX. Load Current
+6.5V	0.8A
+16V	1.0A
+24V	0.25A
+80V	0.1A
+200V	0.3A

2.3.2. Block Diagram



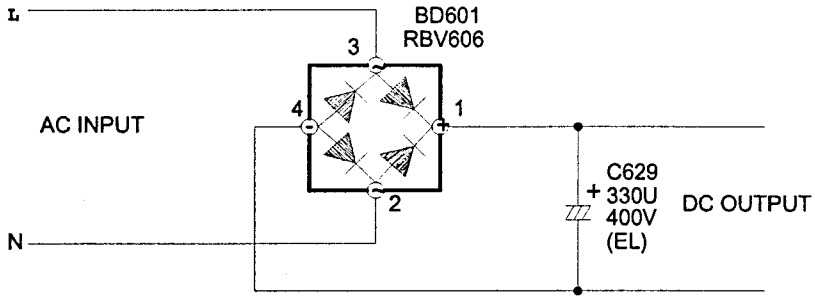
2.3.3. Circuit Operation Theorem

2.3.3.1 RFI FILTER



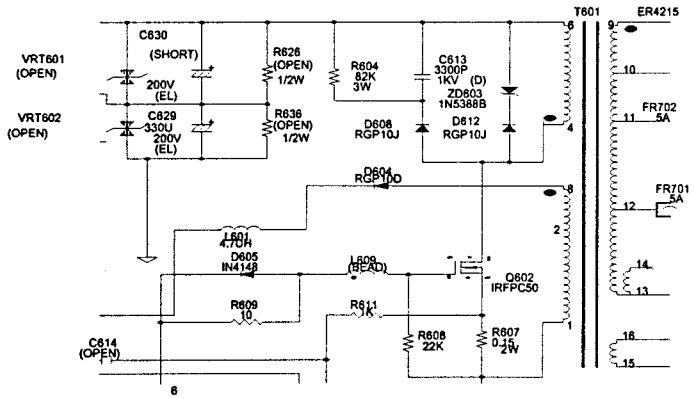
This circuit designed to inhibit electric and magnetic interference for meet FCC, VDE, VCCI standard requirements.

2.3.3.2 Rectifier and filter



When power switch is turn on, the AC voltage is Rectifier and fliter by BD601, C629. The DC output voltage will be 1.4*(ac input)

2.3.3.3 switching Element and isolation transformer



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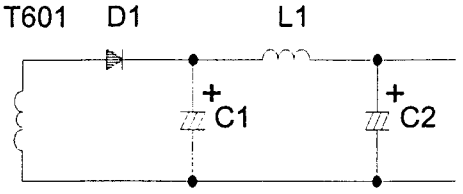
In a flyback converter operated in the discontinuous mode, the energy stored in the flyback transformer (actually an inductor) must be zero at the beginning and end of each switching period .

During the "ON" time, energy taken from the input is stored in the transformer when the switching transistor turn-off, this stored energy is all delivered to the output.

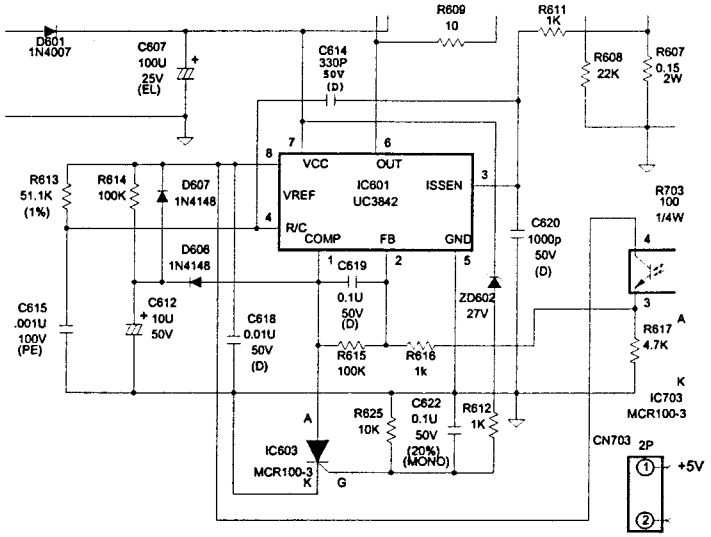
2.3.3.4 Output Rectifier and filter

The structure of each output is illustrated as below



since the transformer T601 acts as a storing energy inductance, diode D1 and capacitor C1 are to produce a dc output and additional L1, C2 to suppress high-frequency switching spikes.

2.3.3.5 Control circuit



The current mode control IC UC3842 is used in the switching power supply which function of each pin described as follows.

pin 1 : Error amplifier output
pin 2 : Error amplifier reverse input
pin 3 : Current sense
pin 4 : OSC sawtooth
pin 5 : Ground
pin 6 : Output
pin 7 : VCC
pin 8 : Reference Voltage:5V

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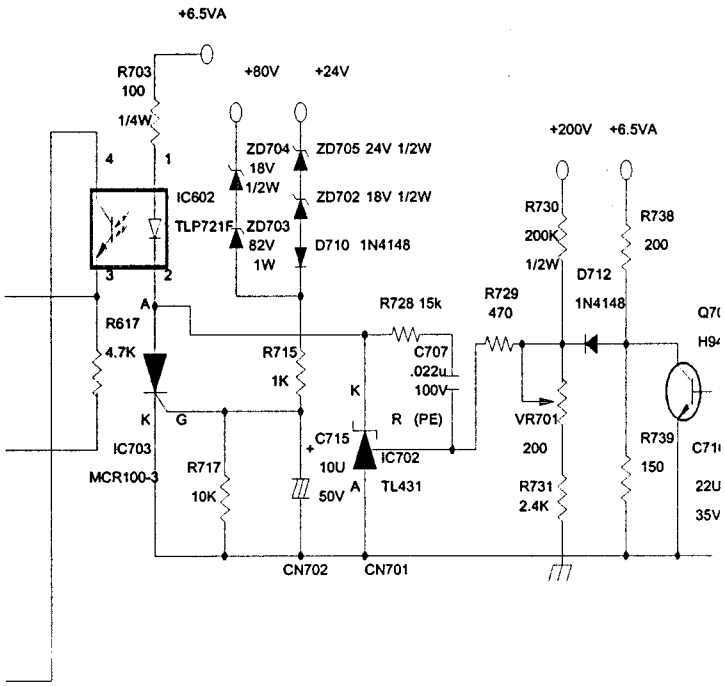
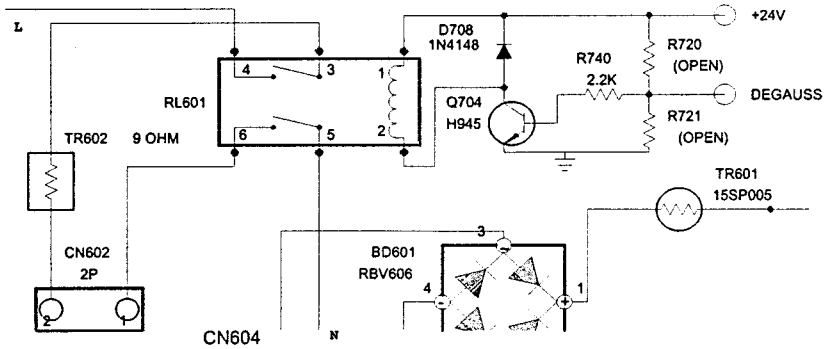
When power is initially applied to the circuit, capacitor C607 charges through C604, R602, D601, D602. When the voltage across C607 reaches a level of 16V, IC601 is turn-on the +5Vdc will beset up at pin8 then R613, C615 generate a fixed frequency sawtooth wave to pin4, at this time MOSFET will be drived by pin6 with square wave the pulse width of square wave is decided by pin2 , pin3 is current feedback control, It will to sense MOSFET current. The D606, D607, R614,C617 are soft start components to avoid the duty too large when power starts up.

2.3.3.6 Feedback circuit

This power supply adopt a single feedback circuit of +200V. It used IC702 for voltage regulation and IC602 for primary-secondary isolation, The output voltage differential signal will be detected and sensed to the pin2 of UC3842 for comparison then the duty cycle of MOSFET will be decided to control the output voltage.



2.3.3.7 DEGAUSS CIRCUIT



This circuit has the function of auto degaussing and manual degaussing. When power supply is switched ON it is auto degaussing stage. When user make the selection of the manual degaussing function in OSD, the degaussing current will flow through coil to degauss the screen of monitor. TR602 is a PTCR to control degaussing coil current

2.3.3.8 power saving control

Mode	H-sync	V-sync	LED	Power Rating
Normal	Normal	Normal	Green	100
Stand-by	None	Normal	Orange	15W
Suspend	Normal	None	Orange Flash	5W

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Off	None	None	Orange Flash	5W

When both of the H-sync and V-sync are none, the power supply +6.3V,+16V,+24V,+80V and +200V output will be cut-off , the power input will be under 5W.
When the H-sync is none , the power supply +16V output will be cut-off . The power input will be under 15W .
When the V-sync is none , the power supply +6.3V,+16V,+24V,+80V and +200V output will be cut-off. The power input will be under 5W.

2.4 Video Circuit

2.4.1. Design Specifications

2.4.1.1 input

D-sub connector

2.4.1.2 sync type

separate sync

composite sync

2.4.1.3 pixel rate =

160 MHz

2.4.1.4 light output (3" block pattern)

40F.L. [brightness at cutoff and contrast at max.]

light output (full white pattern)= 28F.L. [brightness at cutoff and contrast at max.]

2.4.2 CRT Specifications

2.4.2.1 heater voltage

6.3V

2.4.2.2 heater current

0.32A (typical)

2.4.2.3 cathode spot cutoff voltage

110V

2.2.2.4 max-to- min cutoff ratio

1.17

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2.4.3. Block Diagram

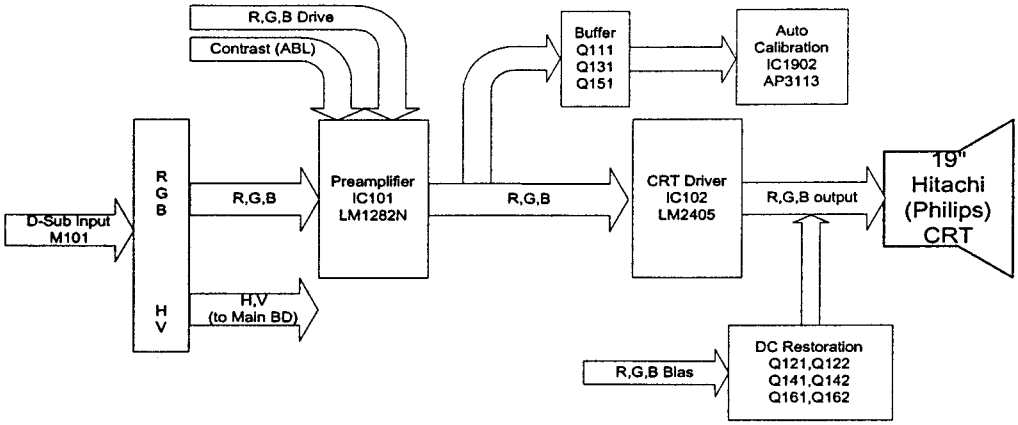

Fig. 1 Block Diagram of 7299SL Video

2.5 Circuit Descriptions

2.5.1 Preamplifier [LM1282]

The IC101, LM1282, is a high bandwidth preamplifier with OSD mixer. When CUT (OSD select) signal is low, video inputs are selected; when CUT signal is high, OSD inputs are selected.
The CONTRAST (and ABL) voltage controls the gain of three guns simultaneously. The R, G, B DRIVE voltage controls the gain of these three guns individually to approach the white balance of CRT.
The HCLAMP signal is used to fix the black level of video signals after AC couple. This is DC Restoration of the preamplifier.
The HBNK signal that is active low is used to pull the LM1282 outputs below 0.2V during non-display period.

2.5.2 CRT Driver [LM2405]

The IC102, LM2405, contains three wide-bandwidth cascode amplifiers. The parasitic capacitance and inductance between IC102 outputs and cathodes will also influence frequency response of IC102.
The diodes and series resistors between cathodes and IC102 output pins are used to protect IC102 during tube arcing.

2.5.3 Buffer [Q111,Q131,Q151]

There are two loads for IC101, one is IC102, another is IC1902. In order to minimize the loading effect on IC101, three emitter followers are inserted between IC101 and IC1901.

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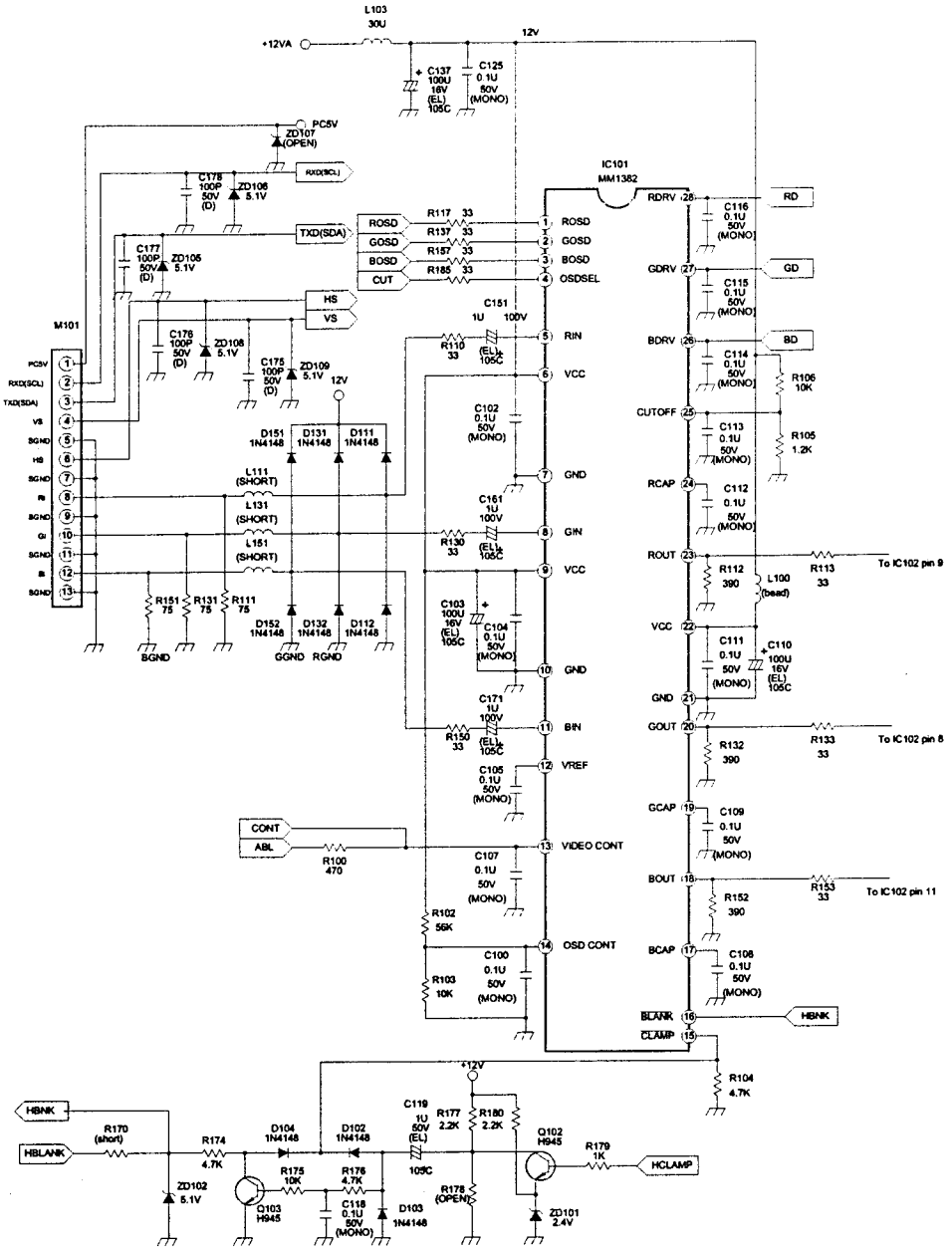

Fig. 2 Preamp IC101

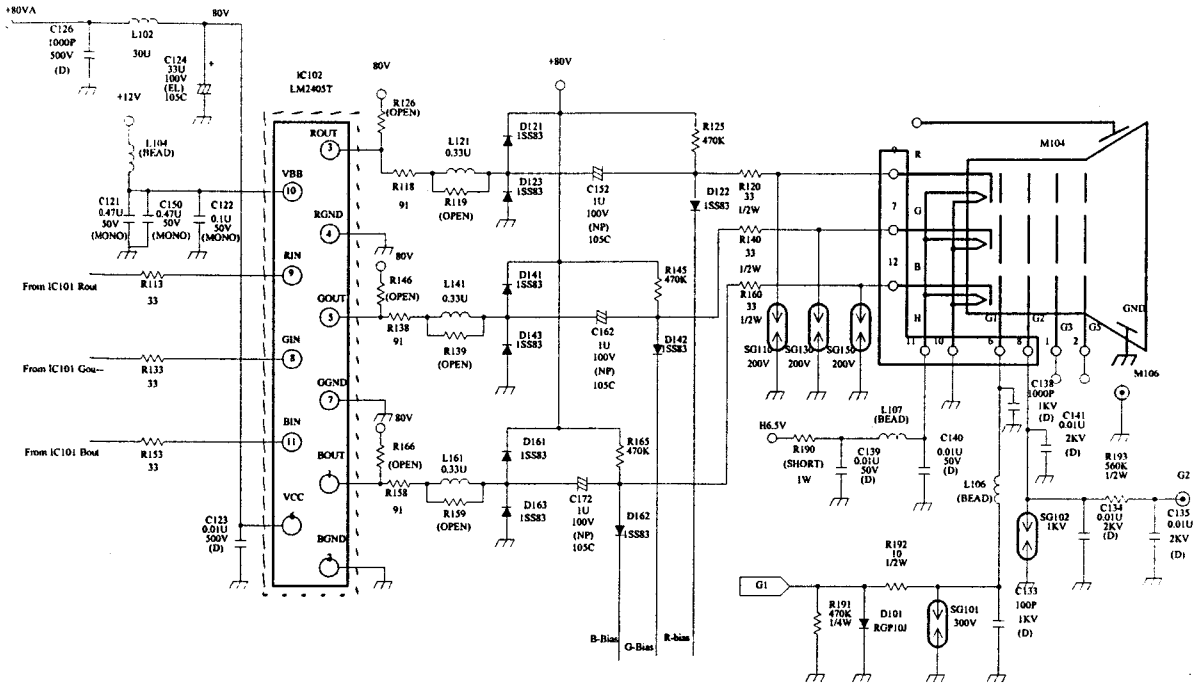

Fig.3 CRT Driver IC102

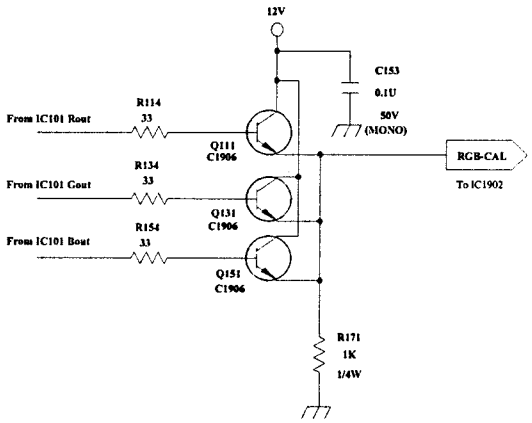

Fig. 4 Buffer

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2.5.4 DC Restoration

The amplified video signals are AC coupled to cathodes. So a DC restoration circuit is needed to fix their DC level. By adjusting R,G,B BIAS voltage, the raster can be set to a specific color temperature.

The control range at Q112/Q132/Q152 emitter is about 80V ~ 53V. Because the blanking pulse at IC102 output is about 10V, the control range of DC level at cathodes is about 70V ~ 43V.

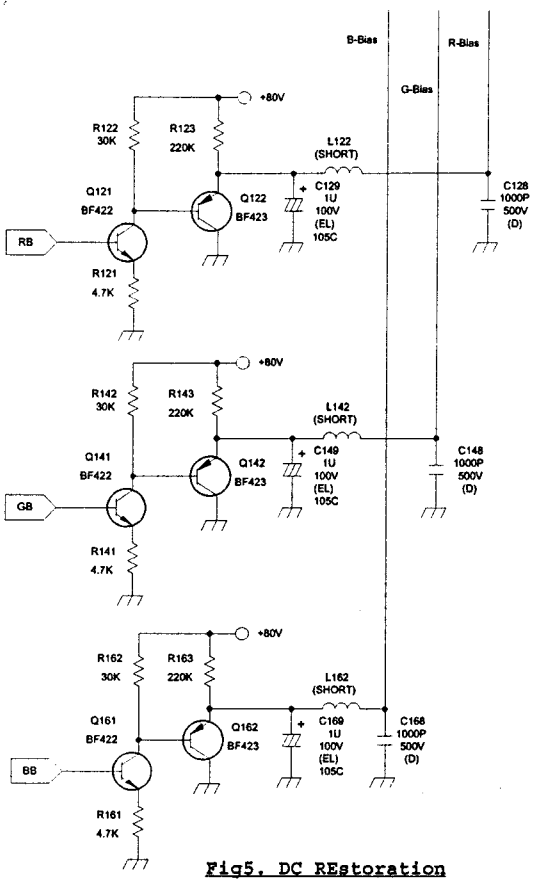

Fig5. DC REstoration

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ALIGNMENT PROCEDURE

3.1Preparation for alignment :

(I) Setup unit and keep it warm up at least 30 minutes
(II) Signal mode

Mode	Frequency (H/V)	Display
1	31.47 K / 70.04 (- / +)	640 * 400 (VGA 1)
2	31.47 K / 59.94 (- / -)	640 * 480 (VGA 1)
3	46.875 K / 75 (+ / +)	800 * 600 (VESA)
4	53.674K / 85.062 (+/+)	800 * 600 (SVGA5)
5	60.02 K / 75 (+ / +)	1024 * 768 (UVGA7)
6	68.677 K / 84.996 (+ / +)	1024 * 768 (UVGA8)
7	79.98K / 75.02 (+ / +)	1280 * 1024(VESA)
8	81.25K / 64.81 (+ / +)	1600 * 1200 (VESA)
9	91.146K / 85.024 (+ / +)	1280 * 1024 (VESA)

3.2 B Adjustment

a. Input mode 91K (1280x1024) with cross-hatch Pattern.
b. Set brightness and contrast in OSD to maximal value
c. Adjust main board VR701 to main **200V ± 0.5V**

3.3 HV Adjustment

a. Input mode 91K (1280x1024) with cross-hatch pattern.
b. Adjust VR302 to let anode voltage be **27±0.1KV (for Hitachi CRT) or 26±0.1KV(for Philips CRT)**

3.4 H-center Adjustment

a. Input mode 91K (1280x1024) with cross-hatch pattern
b. If raster center is near the center of the screen → plug the HECN Wire into M305.
If raster center is near the right side of the screen → plug the HECN Wire into M306.
If raster center is near the left side of the screen → plug the HECN Wire into M307.

3.5 H-size preset

a. Input mode **31K (640x480)** with cross-hatch pattern
b. Use OSD to adjust H-size maximum
c. Adjust VR301 to make H-size **just overscreen**

3.6 Factory setting mode adjustment

1.H-phase : Set picture to the center of screen
2.H-Size : Set picture to 360 ± 2 mm
3.V-center : Set picture to the center of screen
4.V-size : Set picture to 270 ± 2 mm
5.Tilt : Let tilt ±0.5mm between edge to edge
6.Pincushion : Set picture to a real rectangular
7.Unbalance : Set picture to a real rectangular
8.Trapezoid : Set picture to rectangular or balance of top and bottom
9.Parallelogram: Set picture to rectangular or balance of top and bottom
10.Top Corner : Set the line of top corner to a straight line
11.Bottom Corner: Set the line of bottom corner to a straight line

3.7 Focus adjustment

a. Input mode **91K (1280x1024)** with green cross-hatch pattern
b. Adjust V(F2) Focus VR of FBT to make vertical line between center and corner area of CRT clear

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c. Adjust H(F1) to make horizontal line between center and corner area of CRT clear.
d. Repeat step b and c to get the best focus

3.8 Convergence adjustment

a. Input mode 60K (VESA) with cross-hatch patterns
b. Adjust VRs of Yoke and 4-pole , 6-pole to meet specification

3.9 Color Temperature auto alignment

[Input mode : 53.6K/ 85 Hz, SVGA5]
A. REPARING ITEMS
a. PC + QUANTUM DATA card
b. RS232 BOX
c. COLOR ANALYZER (CA100)
d. RS232 CABLE (9P) connect RS232 BOX to PC(COM1)
e. CA100 CABLE to PC(COM2)
f. ADJUST PROGRAM for 7299sl

B. Alignment procedure
a. Press "SPACE BAR " to get raster pattern and set contrast and brightness to maximum position, adjust the G2 VR such that the max. color of R.G.B color bar on the monitor is in the mark region
b. Press "SPACE BAR" to do auto color temperature adjustment and color tracking

C1:	9300K	X= 281 ± 5	Y=311 ± 5
C2:	6500K	X= 313 ± 5	Y=329 ± 5
C3:	5500K	X= 332 ± 5	Y=348 ± 5
C4:	7100K	X= 305 ± 5	Y=315 ± 5
C5:	11500K	X= 275 ± 5	Y=275 ± 5

c. Press "SPACE BAR" to get 3"-block and finish the adjustment

3.10 Clear all of user mode data

After finishing all factory setting , select "Reset to default "at MENU 1 then press enter.

3.10 Geometry Specification ITEM	DESCRIPTION	SPECIFICATION
1	HORI SIZE	360±2 mm
2	VERT SIZE	270±2 mm
3	SIDE PIN	2.0 mm
4	TOP/BOTTOM PIN	2.0 mm
5	SIDE BARREL	1.5 mm
6	TOP/BOTTOM BARREL	1.5 mm
7	TRAPEZOID	4.0 mm
8	VIDEO OFFSET	4.0 mm
9	PARALLELOGRAM	3.5 mm

3.11 Power Saving Function Check

a. Input mode 31KHz (VGA1 640 X 400) with full-white pattern.
b. Press both contrast and brightness keys to maximum position.
[Standby Mode]
c. Remove the **horizontal sync** signal from input, the unit will go into **"Standby"** mode.
The picture will disappear, and the LED indicator is **amber**. The power consumption should be less than **15W**.
[Suspend Mode]
d. Remove **vertical sync** signal from the input, the unit will go into **"Suspend"** mode. The picture will disappear, and the LED indicator is **amber (blinking)**. The power consumption should be less than **5W**.

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[Off Mode]
e. Remove **both syncs** from input, the unit will go into "Off" mode.
The picture will disappear, and the LED indicator is **amber (blinking)**. The power consumptionshould be less than **5W** in this case.
f. Input H-sync and V-sync signals in case c, d and e, the unit will recover to normal state, and the LED indicator is green.

[Override Mode]
g. Disconnect the signal cable from input ,then power on , the unit will go into "Override" mode. The OSD windows will show "no signal", and the LED indicator is green. The power consumption is normal.
h. Re-connect the signal cable in case g, the unit will recover to normal state, and the LED indicator is green.

3.12 USB Test Procedure (Optional)

Introduction

The CATC UHT USB Hub Tester is a modular unit designed for use on the production line to test USB Hubs for proper functionality according to the USB specifications.
The UHT tester performs the following tests:
hub enumeration
hub reset, suspend, and resume operation
connection and enumeration of a low-speed device(on each downstream port)
data loop-back integrity test with a low-speed device(on each downstream port)
connection and enumeration of a full-speed device(on each downstream port)
data look-back integrity test with a full-speed device(on each downstream port)
individual port suspend and resume operations(on each downstream port)
remote wakeup detection and propagation from each of the downstream ports
hub-initiated remote wakeup on connect/disconnect events
hub overcurrent detection and reporting to the host
overcurrent protection(gang or per-port configuration)
downstream current restoration(overcurrent removed)

System Setup

Position the CATC UHT box on the test bench, near the USB hub to be evaluated. Connect the DC plug of the AC to 9V DC@500mA power converter to the +9V power receptacle of the CATC UHT box. To activate the unit, plug the AC to DC converter into an appropriate AC power outlet.
In the USB test system, connect the CATC UHT box as follow:
Connect a USB cable between the upstream port of the USB hub under test and the USB port of the host PC.
Connect a USB cable between the first downstream port to be tested and the USB connectoe labeled "CH1".
Repeat step B for the next ports to be tested, connecting to "CH2", "CH3", "CH4" in sequence.

Software Installation

Make a copy of the CATC diskette for backup, then copy its contents to the hard drive of the USB-capable PC to be used as the test system host. The UHT software program (usb_uht.exe) is a DOS application,and must be run under the DOS operating system. It supports both UHCI and OHCI USB hoost controller implementations.
To run the program, at the DOS prompt, type USB_UHT and press "Enter" key. The program will clear the monitor screen and begin execution. During the test, the program displays the test results on the monitor screen. To terminate the program and get back to the DOS prompt, press any key.

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CHAPTER 4

TROUBLESHOOTING

4.1 Introduction

This Acer 7299sl trouble shooting guide has flow chart and trouble list to show the easy problem solution for engineers. Please according to this guide and step by step to maintain your Acer 7299sl when the system has any trouble.

System trouble category

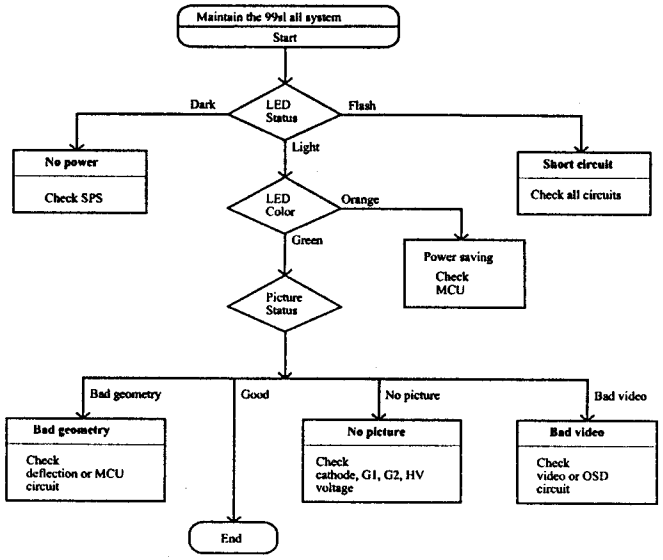

Figure.1 Main flow chart for trouble category

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4.2 Trouble shooting for short circuit

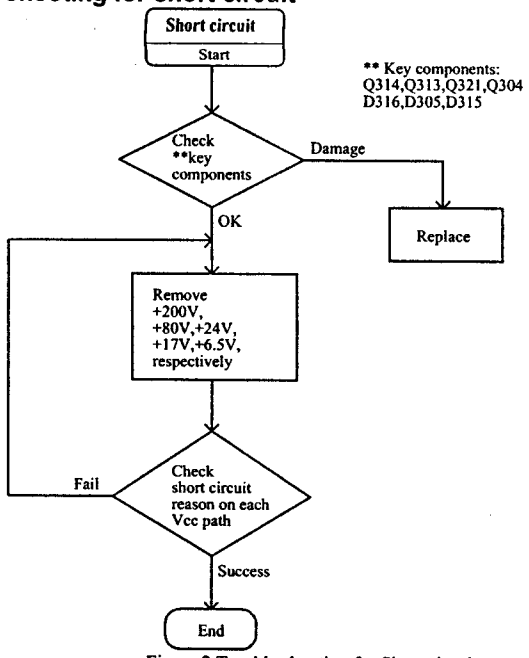

Figure.2 Trouble shooting for Short circuit

4.3 Trouble shooting for bad geometry

Item	Status	Reason	Check	Note
1	Vertical one line	Hor. deflection failure	RF3958,Q314,Q321,L304, R363	
2	Horizontal one line	Ver. deflection failure	IC201,RF209,ZD201, ZD202,C203,RF208	
3	Bad focus	Dynamic focus failure	Q404,C402,Q403, T401,Q405,C403	
4	Picture dimension too large	HV less than 26KV	Adjust VR302	
5	Picture dimension too large	HV feedback circuit failure	IC302,IC301, D345	
6	Picture dimension too small	HV greater than 26KV	Adjust VR302	
7	Picture dimension too small	HV feedback circuit failure	IC302,IC301,D345	
8	Bad H-linearity	Cs switching error	IC307,Q325,Q326, Q327,Q328,Q329 or check MCU circuit SC0~SC4	
9	H-linearity unbalance	Linear coil malfunction	Q324,L305 ,Q348,Q349	
10	Bad V-linearity	Ver. circuit failure	IC201	
11	Asynchronization	AFC feedback failure	IC304	
12	Asynchronization	Defelction IC failure	IC304,C355,C354,R3922,C356,C353,C352	
13	Spot when power OFF	Spot killer circuit failure	Q256,Q253,ZD305,ZD306	
14	Hor. size too small	H-size VR had not been adjusted	Adjust VR301	
15	Ver. size too small	Ver. output abnormal	R207,R216, IC304	
16	Appear retrace line	V-blanking failure	IC201,Q254,Q255	
17	Geometry cannot be adjusted	MCU or defection circuit failure	IC801,IC304	
18	ABL cannot be adjusted	ABL circuit failure	Q301,Q318	
19	Tilt cannot be adjusted	Tilt circuit or MCU failure	IC401,Q411,Q412	
20	Upper left and right picture distortion	H-size RLC filter failure	L304,R363,C332	

4.4 Trouble shooting for no picture

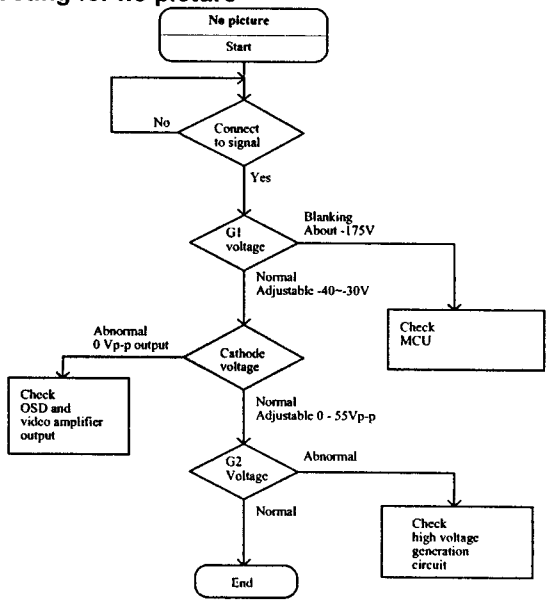

Figure.3 Trouble shooting for no picture

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Item	Status	Reason	Check	Note
1	LED ON, but no picture	G2 voltage too small	Adjust G2	
2	LED ON, but no picture	No high voltage	RF3929,Q313,Q304,D305	
3	LED ON, but no picture	X-Ray protection	Q360,ZD310,Q312	
4	LED ON, but no picture	MCU blanking	IC801	
5	LED ON, but no picture	Hor. output mute	RF3958,Q3821,Q314,Q321	
6	LED ON,but no picture	No video output	IC102,IC1901,IC101,IC801	
7	LED ON, but no picture	CRT heater burn out	Replace CRT	

4.5 Trouble Shooting for bad video

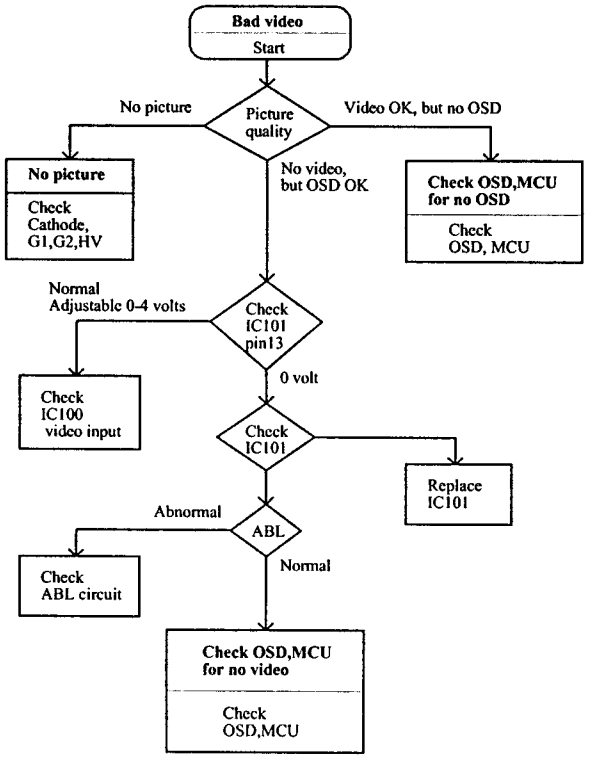

Figure.4 Trouble shooting for bad video

Item	Status	Reason	Check	Note
1	No video	Short circuit damage	IC102,IC101	
2	No video	Video blank	Q352,IC101	
3	No video	Video contrast zero	IC1901,IC101	

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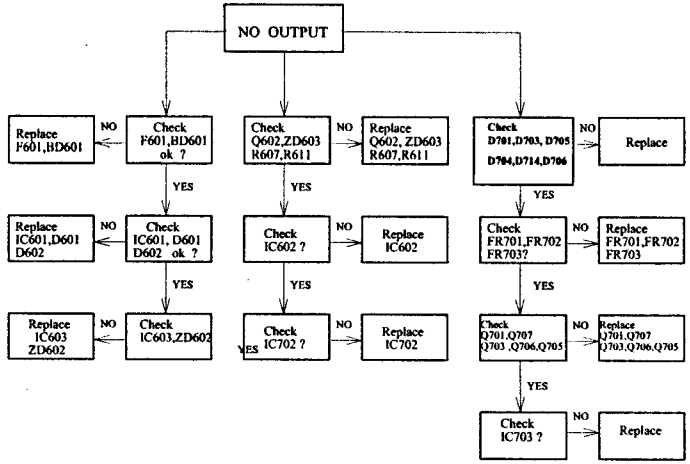
4	Video smear or tilt	Check Hclamp pulse	IC101,IC102,Q102,Q103	
5	Bad video quality	Check IC101,IC102	IC101,IC102	
6	Lack one or more video color	Video output path open or short circuit	Check open or short circuit from video input to output	
7	Lack one or more video color	Components damage	IC102,IC101	
8	Free run mode OSD smear	No clamp pulse for IC101	Q102,Q103,Q352	
9	No Hor. blanking	H-blank failure	Q102,Q103,Q352	
10	RGB drive cannot be adjusted	OSD IC damage	IC1901	
11	RGB bias cannot not be adjusted	OSD IC damage or DC restoration circuit failure	Q122,Q142,Q162,IC1901	
12	OSD cannot display	OSD	IC1901	
13	Brightness cannot be adjusted	G1 Circuit is abnormal	Check G1 circuit	
14	Picture is too bright/dark	G2 voltage too large	Adjust G2	
15	Picture is too bright/dark	G1 voltage too large	ZD305,ZD306,Q256,Q253	

4.6 Power supply

POWER NO OUTPUT



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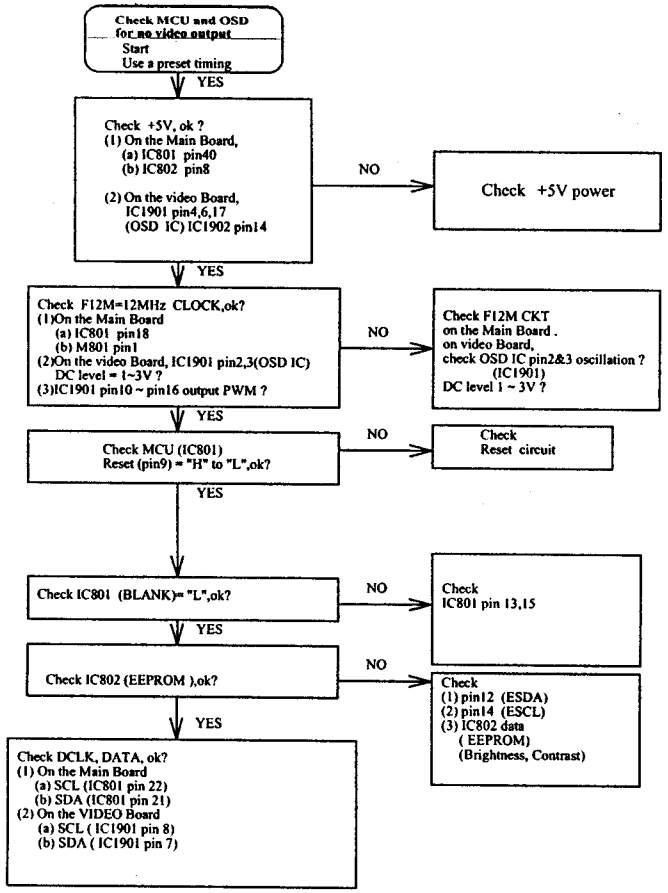
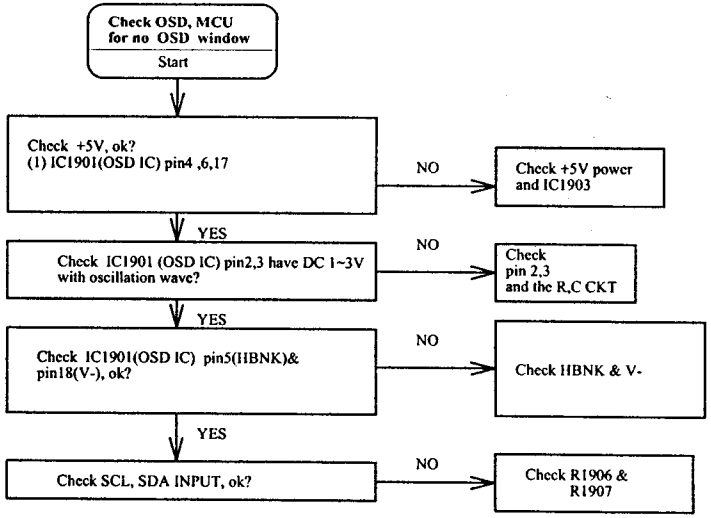
4.7 Check MCU and OSD for no video output



4.8 Check OSD, MCU for no OSD window



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Appendix A

7299SL Spare Parts List

PART NUMBER	DESCRIPTION	LOCATION
55.71M01.010	MAIN BD 7299SL PHILIPS/TCO	
01.00112.000	IC MONI CTRL MTV112E	IC801
02.24C08.000	IC EEPROM 24C08 8K DIP 8P	IC802
04.00082.010	IC OP TL082 DIP 8P	IC302
04.00324.010	IC OP LM324 DIP 14P	IC401
04.00393.020	IC V.C. LM393 DIP 8P	IC301
04.03842.040	IC V.R. UC3842 DIP 8P	IC601
04.04856.071	IC SYNC CTRL TDA4856	IC304
05.00721.010	PHOTO TLP721F	IC602
06.00634.020	FET MOS IRFI 634 G TO-220	Q304
06.00630.020	FET MOS IRF630	Q405, Q315
06.00857.010	XTOR 2SB857 B TO-220	Q705, Q708
06.066GY.14X	LED D5*8.3 GRN/YEL	LED701
06.2R0A0.120	DIODE FAST 2NU41 1KV 2A	D701,D703, D714
06.3R020.120	DIODE FAST RGP30D 200V 3A	D706
06.3R020.121	DIODE FAST EGP300 L-5301	D704
06.3R040.120	DIODE FAST RGP30GL-5304	D705
06.3R040.123	DIODE FAST UF5404L-5302	D305, D315
06.4R060.151	DIODE BRI D 3SBA60 600V 4A	
06.5R0F0.122	DIODE FAST 5TU Z47 1.5KV 5A	D316
08.47216.354	CAP DISC Y1 4700P 250V	C624
09.1061K.08C	CAP EL 10U 350V	C303
09.1061M.01C	CAP EL 10U 450V	C256
09.10716.08D	CAP EL 100U 250V	C365
09.22616.08C	CAP EL 22U 250V	C319
09.33717.084	CAP EL 330U 400V	C629
11.10437.12K	CAP PMH 0.1U 400V	C338
11.15337.064	CAP PP 0.015U 400V	C404
11.18437.T0E	CAP PMA 0.18U 400V	C336
11.22436.12E	CAP PMH 0.22U 250V	C339
11.22437.03K	CAP MPE 0.22U 400V	C604
11.33336.064	CAP MPP 0.033U 250V	C309
11.33436.12E	CAP PMH 0.33U 250V	C381
11.39437.12K	CAP PMH 0.39U 400V	C340
11.47436.06K	CAP MPP 0.47u 250V	C3906
11.5123S.T5K	CAP PHA 5100P 1.8KV	C3909
11.68337.12E	CAP MPS 0.068U 400V	C337
13.10036.07H	RES MOFM 10 J 3W	R365
13.10137.074	RES MOFM 100 J 5W	R3918
13.18137.074	RES MOFM 180 J 5W	R328
13.1R237.074	RES MOFM 1.2 J 5W	R344
13.22036.09H	RES FMFR 22 J 3W	RF3929
13.22037.074	RES MOF 22 J 5W	R363
13.22236.07H	RES MOFM 2.2K 3W	R3969
13.2R237.074	RES MOFM 2.2 J 5W	R3802

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13.33037.07I	RES MOFM 33 J 5W	R378, R3990
13.82336.07H	RES MOFM 82K J 3W	R604
17.60033.00A	THERM 5/15 NTC RF8	TR601
17.60051.9R0	THERM 9 OHM PTC 2P	TR602
19.20104.001	XFORM H-DRV EI-19	T302 ⚠ ⚠
19.20119.001	XFORM PWR EE42-15	T601
19.26029.001	XFORM DRIVE 4.0MH	T304
19.40102.001	CHOKE COIL 5MH DR 16*18	L304, L307
19.40102.021	CHOKE 1.1MH EER-28L	L303
19.40131.001	LINE FILTER 18MH	L606
19.50049.011	LINEAR COIL 3.3UH 7299SL	L305
19.90041.001	COIL DEGAUSSING 7299C	
19.70054.001	XFORM FBT 7299SL	T301
19.90046.001	FOCUS TRANSFORMER	T401
22.50015.031	RELAY RY-5W-K	RL701
22.50025.001	RELAY OMI-SS-224LM	RL601
23.30008.001	XTAL 12MHZ 32P	Y801
26.14001.113	FUSE 4A 250V ST20	F601
27.82718.011	CORD H05W-F#18*3C 10A250V	
04.00431.030	IC V.R. LM431A TO-92T 3P	IC702
06.00014.020	FET MOS FS14SM-12 600V 14A	Q602
06.00031.01C	XTOR/MOS TIP31 C TO-220	Q324
06.00100.052	SCR MCR100-6 400V 0.8A	Q360,IC603,IC703 ⚠
06.01906.010	TRANSISTOR 2SC1906	Q801,Q352
06.02235.010	XTOR 2SC2235 Y TO-92T	Q312
06.1R003.110	DIODE S.B. 1N5818 30V	D308,D307
06.1R040.030	DIODE REC 1N4004 400V	D601,D602
06.1R040.120	DIODE FAST RGP10G 400V 1A	D302,D348,D3703, D3704
06.1R0A0.120	DIODE FAST RGP10M 1KV 1A	D401,D402
06.1R0A0.122	DIODE FAST UF4007 1KV 1A	D608,D612
08.1012A.13W	CAP DISC 100P 1KV	C621,C305,C133
08.1012C.02W	CAP DISC 100P 2KV	C3901,C414,C415
08.1822G.13W	CAP DISC 1800P 500V	C3902
08.2212A.13W	CAP DISC 220P 1KV	C721,C720,C635
08.2222G.13W	CAP DISC 2200P 500V	C717,C718
08.3303G.01W	CAP DISC 33P 500V	C3903
08.3321A.03A	CAP DISC 3300P 1KV	C613
08.4712G.13W	CAP DISC 470P 500V	C369
08.4722A.13W	CAP DISC 4700P 1KV	C402
08.5612A.13W	CAP DISC 560P 1KV	C722
08.6812G.13W	CAP DISC 680P 500V	C3821
09.47416.01W	CAP EL 0.47U 250V	C254,C255
17.60030.00A	THERM 100/5 NTC	TR201
18.10122.03D	PEAK COIL 100UH	L306
18.4R722.03D	PEAK COIL 4.7UH	L605
55.71M02.001	VIDEO BD 7299SL (MI)	
01.03113.000	IC ASIC AP3113	IC1902

01.03114.001	IC ASIC AP3114	IC1901
04.01282.010	IC VIDEO AMP LM1282	IC101
04.02405.140	IC CRT DRV LM2405 SIP 11P	IC102
04.02940.030	IC V.R. LM2940CT	IC1903
08.1039C.144	CAP DISC 0.01U 2KV	C134,C135,C141
04.07812.030	IC V.R. 7812 TO-220 3P	IC303
04.08351.070	IC VERT DEFLECT TDA8351 DIP	IC201
06.00422.010	XTOR BF422 TO-92T	Q121,Q141,Q161
06.00423.010	XTOR BF423 TO-92T	Q122,Q142,Q162
06.00945.010	XTOR 2SC945P TO92T	Q102,Q103
06.01906.010	XTOR 2SC1906 TO92T	Q131,Q111,Q151
08.1012A.13W	CAP DISC 100P 1KV	C133
08.1022A.13W	CAP DISC 1000P 1KV	C132
08.1022G.13W	CAP DISC 1000P 500V	C148,C130,C168,C128 C126,C120
08.1031G.03W	CAP DISC 0.01U 500V	C123
50.71M06.201	SINGAL/C 13/15P 1860MM	
56.0571M.XXX	CRT 19" M46EJC325X100/F01	
60.71M03.XXX	ASSY BASE C2800 002 99SL	
60.71M16.XXX	ASSY BZL C2800 002	
60.71M17.XXX	ASSY U/C C2800 002 99SL	
42.77504.021	BAG PE LDPE 900*800 ALL	
44.74201.XXX	CTN AB 574*545*600	
47.71M03.001	CSN T-L EPS BASE ATT. 7299SL	
47.71M04.001	CSN T-R EPS BASE ATT. 7299SL	
47.71M05.001	CSN BTM EPS BASE ATT. 7299SL	
49.71M01.XXX	MANUAL ACER 7299SL	

Important Service Instruction

⚠ : The components identified by the mark of ⚠ in the schematic are important X-radiation and safety parts. Should replacement is required, replace only with the same type and rating originally used.

⚠ :The components identified by the mark of ⚠ in the schematic are important safety parts. If replacement is required, refer to service manual to re-adjust and/or re-checked the B+ and high voltage to reach the specified value.

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7299sl (AV99sl) Spare Parts List

ISSUE DATE: January 21, 1999

P/N: 91.71M02.xxx

ITEM	DESCRIPTION	PART NO.	LOCATION
1	IC MONI CTRL MTV112E	01.00112.000	IC801
2	IC ASIC AP3113	01.03113.000	IC1902
3	IC ASIC AP3114	01.03114.001	IC1901
4	IC EEPROM 24C08 8K DIP 8P	02.24C08.000	IC802
** Please advise model name and location when you order above IC EEPROM, then, we could write program in advance.			
5	IC OP TL082 DIP 8P	04.00082.010	IC302
6	IC OP LM324 DIP 14P	04.00324.010	IC401
7	IC V.C. LM393 DIP 8P	04.00393.020	IC301
8	IC V.R. LM431A TO-92T 3P	04.00431.030	IC702
9	IC VIDEO AMP LM1282	04.01282.010	IC101
10	IC CRT DRV LM2405 SIP 11P	04.02405.140	IC102
11	IC V.R. LM2940CT	04.02940.030	IC1903
12	IC V.R. UC3842 DIP 8P	04.03842.040	IC601
13	IC SYNC CTRL TDA4856	04.04856.071	IC304
14	IC V.R. 7812 TO-220 3P	04.07812.030	IC303
15	IC VERT DEFLECT TDA8351 DIP	04.08351.070	IC201
16	PHOTO TLP721F	05.00721.010	IC602
17	FET MOS FS14SM-12 600V 14A TO-3	06.00014.020	Q602
18	XTOR/MOS TIP31 C TO-220 NPN P	06.00031.01C	Q324
19	SCR MCR100-6 400V 0.8A	06.00100.052	Q360,IC603,IC703
20	XTOR BF422 TO-92T	06.00422.010	Q121,Q141,Q161
21	XTOR BF423 TO-92T	06.00423.010	Q122,Q142,Q162
22	FET MOS IRF630	06.00630.020	Q405, Q315
23	FET MOS IRFI 634 G TO-220	06.00634.020	Q304
24	XTOR 2SB857 B TO-220	06.00857.010	Q705, Q708
25	XTOR 2SC945P TO92T	06.00945.010	Q102,Q103
26	XTOR 2SC1906 TO92T	06.01906.010	Q131,Q111,Q151, Q801,Q352
27	XTOR 2SC2235 Y TO-92T	06.02235.010	Q312
28	XTOR BU2508DX SOT 399 NPN P	06.02508.01E	Q313

29	FET MOS SLA5046 12P	06.05046.020	IC307
30	XTPR 2SC5584 SOT 430 NPN P	06.05584.010	Q314
31	LED D5*8.3 GRN/YEL	06.066GY.14X	LED701
32	FET MOS SFS9634 NC TO-220F	06.09634.020	Q321
33	DIODE S.B. 1N5818 30V	06.1R003.110	D308,D307
34	DIODE REC 1N4004 400V	06.1R040.030	D601,D602
35	DIODE FAST RGP10G 400V 1A	06.1R040.120	D302,D348,D3703,D3704
36	DIODE FAST RGP10M 1KV 1A	06.1R0A0.120	D401,D402
37	DIODE FAST UF4007 1KV 1A	06.1R0A0.122	D608,D612
38	DIODE FAST 2NU41 1KV 2A	06.2R0A0.120	D701,D703, D714
39	DIODE FAST RGP30D 200V 3A	06.3R020.120	D706
40	DIODE FAST EGP300 L-5301 200V 3A	06.3R020.121	D704
41	DIODE FAST RGP30GL-5304	06.3R040.120	D705
42	DIODE FAST UF5404L-5302	06.3R040.123	D305, D315
43	DIODE BRI D 3SBA60 600V 4A	06.4R060.151	
44	DIODE FAST 5TU Z47 1.5KV 5A	06.5R0F0.122	D316
45	CAP DISC 100P 1KV	08.1012A.13W	C621,C305 ,C133
46	CAP DISC 100P 2KV	08.1012C.02W	C3901,C414,C415
47	CAP DISC 1000P 1KV	08.1022A.13W	C132
48	CAP DISC 1000P 500V	08.1022G.13W	C148,C130,C168,C128C126,C120
49	CAP DISC 0.01U 500V	08.1031G.03W	C123
50	CAP DISC 0.01U 2KV	08.1039C.144	C134,C135,C141
51	CAP DISC 1800P 500V	08.1822G.13W	C3902
52	CAP DISC 220P 1KV	08.2212A.13W	C721,C720,C635
53	CAP DISC 2200P 500V	08.2222G.13W	C717,C718
54	CAP DISC 33P 500V	08.3303G.01W	C3903
55	CAP DISC 3300P 1KV	08.3321A.03A	C613
56	CAP DISC 470P 500V	08.4712G.13W	C369
57	CAP DISC Y1 4700P 250V	08.47216.354	C624
58	CAP DISC 4700P 1KV	08.4722A.13W	C402
59	CAP DISC 560P 1KV	08.5612A.13W	C722
60	CAP DISC 680P 500V	08.6812G.13W	C3821

61	CAP EL 10U 350V	09.1061K.08C	C303
62	CAP EL 10U 450V	09.1061M.01C	C256
63	CAP EL 100U 250V	09.10716.08D	C365
64	CAP EL 22U 250V	09.22616.08C	C319
65	CAP EL 330U 400V	09.33717.084	C629
66	CAP EL 0.47U 250V	09.47416.01W	C254,C255
67	CAP PMH 0.1U 400V	11.10437.12K	C338
68	CAP PP 0.015U 400V	11.15337.064	C404
69	CAP PMA 0.18U 400V	11.18437.T0E	C336
70	CAP PMH 0.22U 250V	11.22436.12E	C339
71	CAP MPE 0.22U 400V	11.22437.03K	C604
72	CAP MPP 0.033U 250V	11.33336.064	C309
73	CAP PMH 0.33U 250V	11.33436.12E	C381
74	CAP PMH 0.39U 400V	11.39437.12K	C340
75	CAP MPP 0.47u 250V	11.47436.06K	C3906
76	CAP PHA 5100P 1.8KV	11.5123S.T5K	C3909
77	CAP MPS 0.068U 400V	11.68337.12E	C337
78	RES MOFM 10 J 3W	13.10036.07H	R365
79	RES MOFM 100 J 5W	13.10137.074	R3918
80	RES MOFM 180 J 5W	13.18137.074	R328
81	RES MOFM 1.2 J 5W	13.1R237.074	R344
82	RES FMFR 22 J 3W	13.22036.09H	RF3929
83	RES MOF 22 J 5W	13.22037.074	R363
84	RES MOFM 2.2K 3W	13.22236.07H	R3969
85	RES MOFM 2.2 J 5W	13.2R237.074	R3802
86	RES MOFM 33 J 5W	13.33037.07I	R378, R3990
87	RES MOFM 82K J 3W	13.82336.07H	R604
88	THERM 100/5 NTC	17.60030.00A	TR201
89	THERM 5/15 NTC RF8	17.60033.00A	TR601
90	THERM 9 OHM PTC 2P	17.60051.9R0	TR602
91	PEAK COIL 100UH	18.10122.03D	L306
92	PEAK COIL 4.7UH	18.4R722.03D	L605
93	XFORM H-DRV EI-19	19.20104.001	T302

94	XFORM PWR EE42-15	19.20119.001	T601
95	XFORM DRIVE 4.0MH	19.26029.001	T304
96	CHOKE COIL 5MH DR 16*18	19.40102.001	L304, L307
97	CHOKE 1.1MH EER-28L	19.40102.021	L303
98	LINE FILTER 18MH	19.40131.001	L606
99	LINEAR COIL 3.3UH 7299SL	19.50049.011	L305
100	COIL DEGAUSSING 7299C	19.90041.001	
101	FOCUS TRANSFORMER	19.90046.001	T401
102	SKT AC I/P 10A 250V 0714 (PIN)	22.10041.151	CN601
103	RELAY RY-5W-K	22.50015.031	RL701
104	RELAY OMI-SS-224LM	22.50025.001	RL601
105	XTAL 12MHZ 32P	23.30008.001	Y801
106	FUSE 4A 250V ST20	26.14001.113	F601
107	CORD H05W-F#18*3C 10A250V EUR	27.82718.011	
108	BAG PE LDPE 900*800 ALL	42.77504.021	

**** 7299sl (AV99sl) Board & CRT & Cosmetics & FBT – 91.71M02.001 / 002**

1	MAIN BD 7299SL PHILIPS/TCO (MI)	55.71M01.010	91.71M02.001 / 002
2	VIDEO BD 7299SL (MI)	55.71M02.001	91.71M02.001 / 002
3	XFORM FBT 7299SL (T301)	19.70054.001	91.71M02.001 / 002
4	CTN AB 574*545*600 7299C/ACER	44.74201.001	91.71M02.001 / 002
5	CSN T-L EPS BASE ATT. 7299SL	47.71M03.001	91.71M02.001 / 002
6	CSN T-R EPS BASE ATT. 7299SL	47.71M04.001	91.71M02.001 / 002
7	CSN BTM EPS BASE ATT. 7299SL	47.71M05.001	91.71M02.001 / 002
8	MANU USR 5LS 7299SL TCO95	49.71M02.001	91.71M02.001
	MANUAL ACER 7299SL TCO99	49.71M01.011	91.71M02.002
9	SIGNAL/C 13/15P 1860MM 002	50.71M06.201	91.71M02.001 / 002
10	CRT 19" M46LPC 183X01(E)/HTC	56.0571M.001	91.71M02.001
	CRT 19" M46EJC325X100/F01 PHIL	56.0571M.011	91.71M01.002
11	ASSY BZL 002 7299SL PHIL TCO95	60.71M11.001	91.71M02.001
	ASSY BZL C2800 002 PHIL TCO99	60.71M16.001	91.71M01.002
12	ASSY U CASE 002 7299SL	60.71M02.001	91.71M02.001
	ASSY U/C C2800 002 99SL TCO99	60.71M17.001	91.71M01.002
13	ASSY BASE 002 7299SL	60.71M03.001	91.71M02.001

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	ASSY BASE C2800 002 99SL TCO99	60.71M03.011	91.71M01.002

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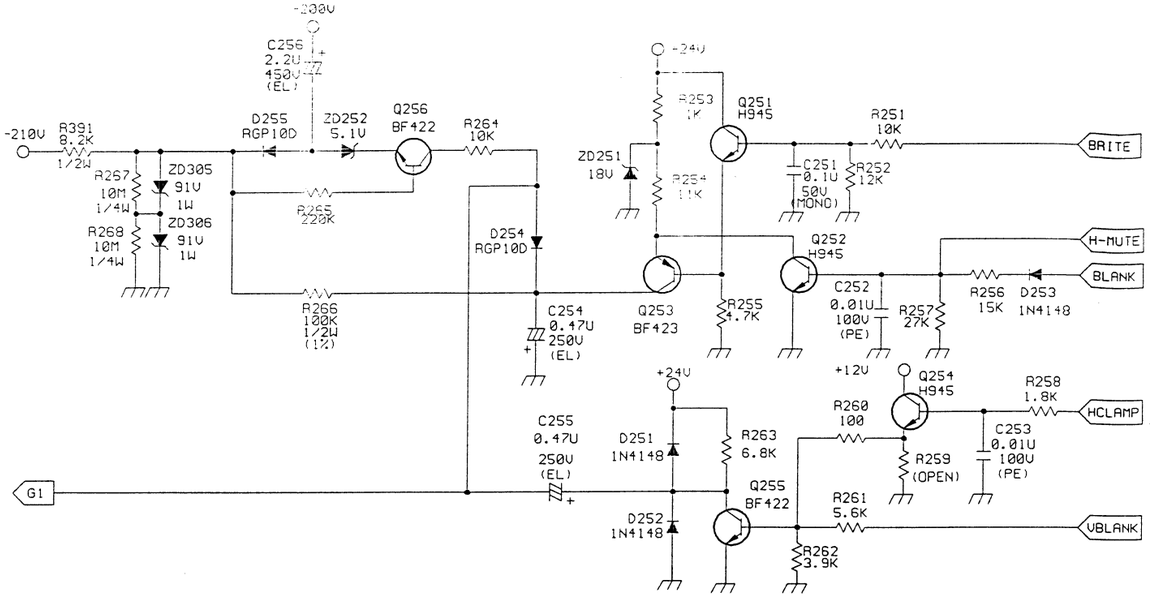
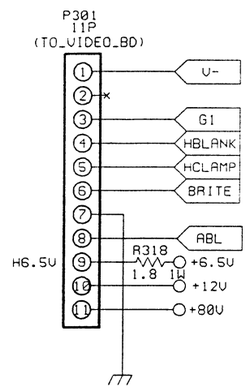
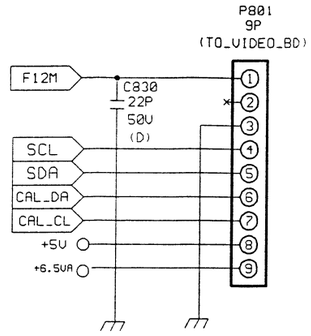
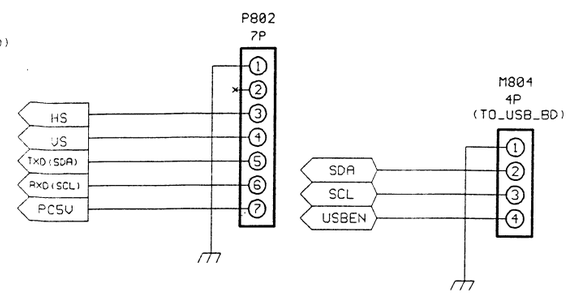


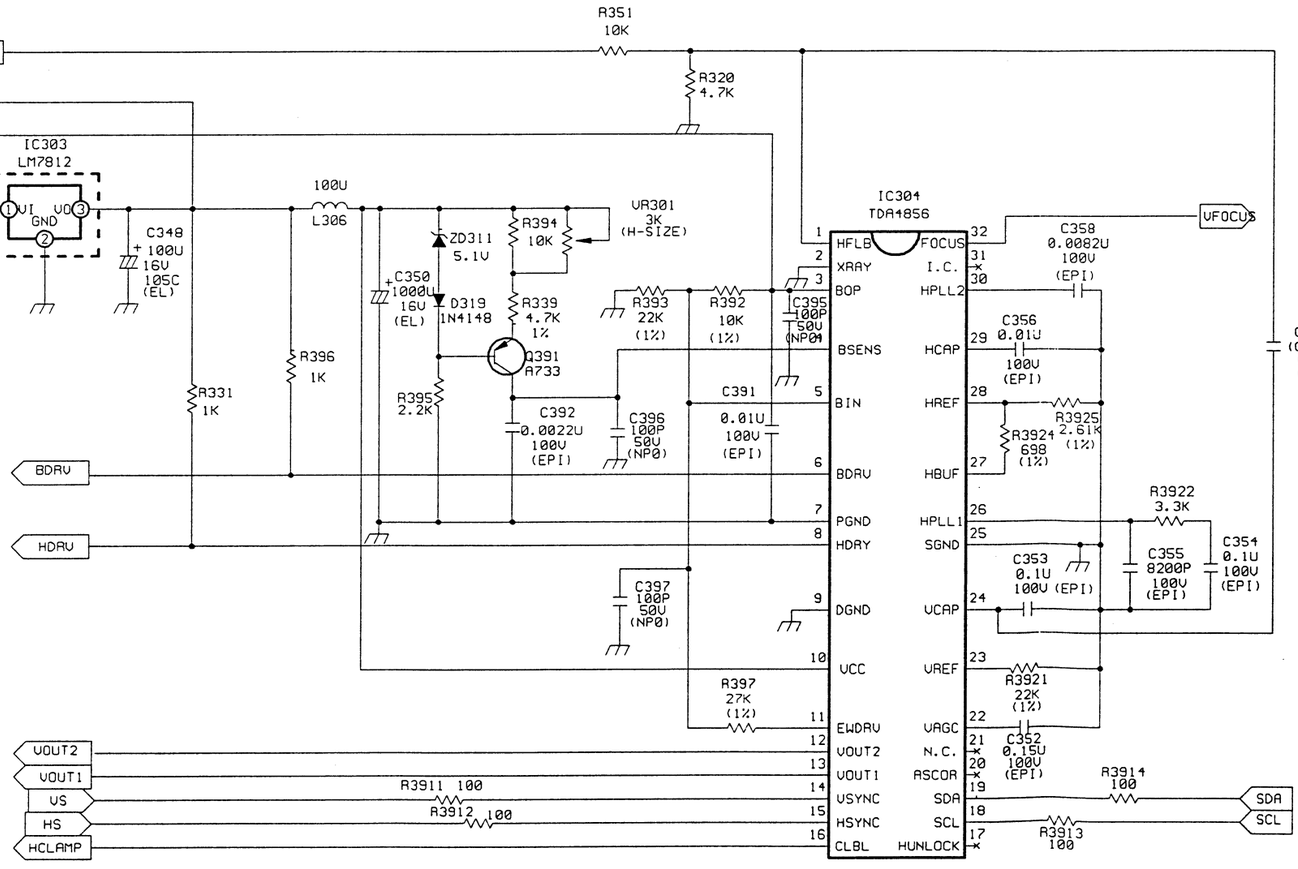


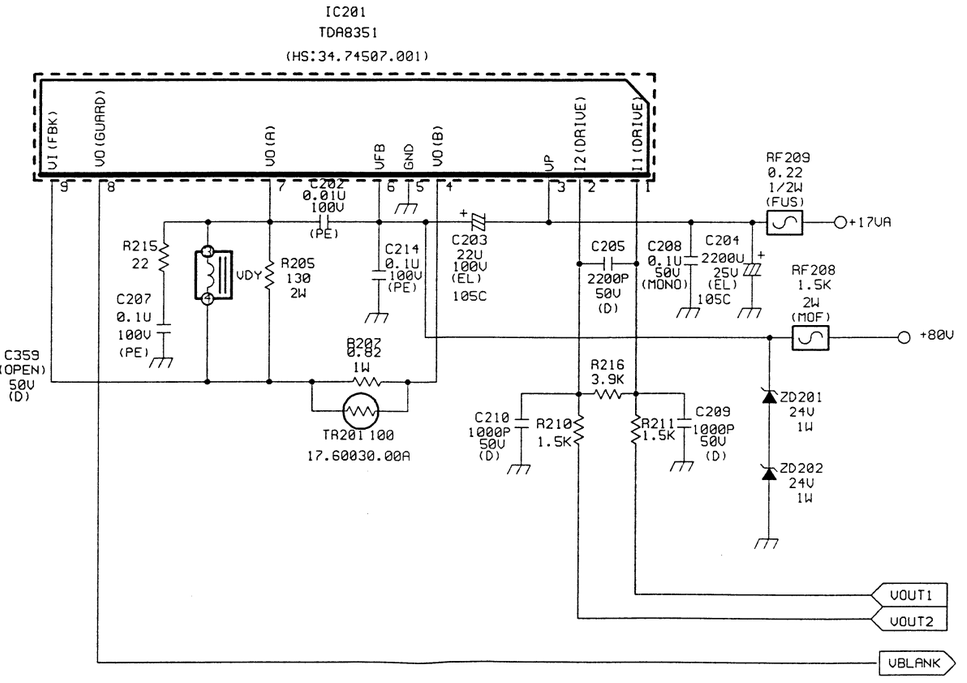




HITACHI CRT

* R397=56K 1%
* R205=82;R207=0.56
* R388=4.7K
* C403=0.0082U/250V/PP





MC-Service

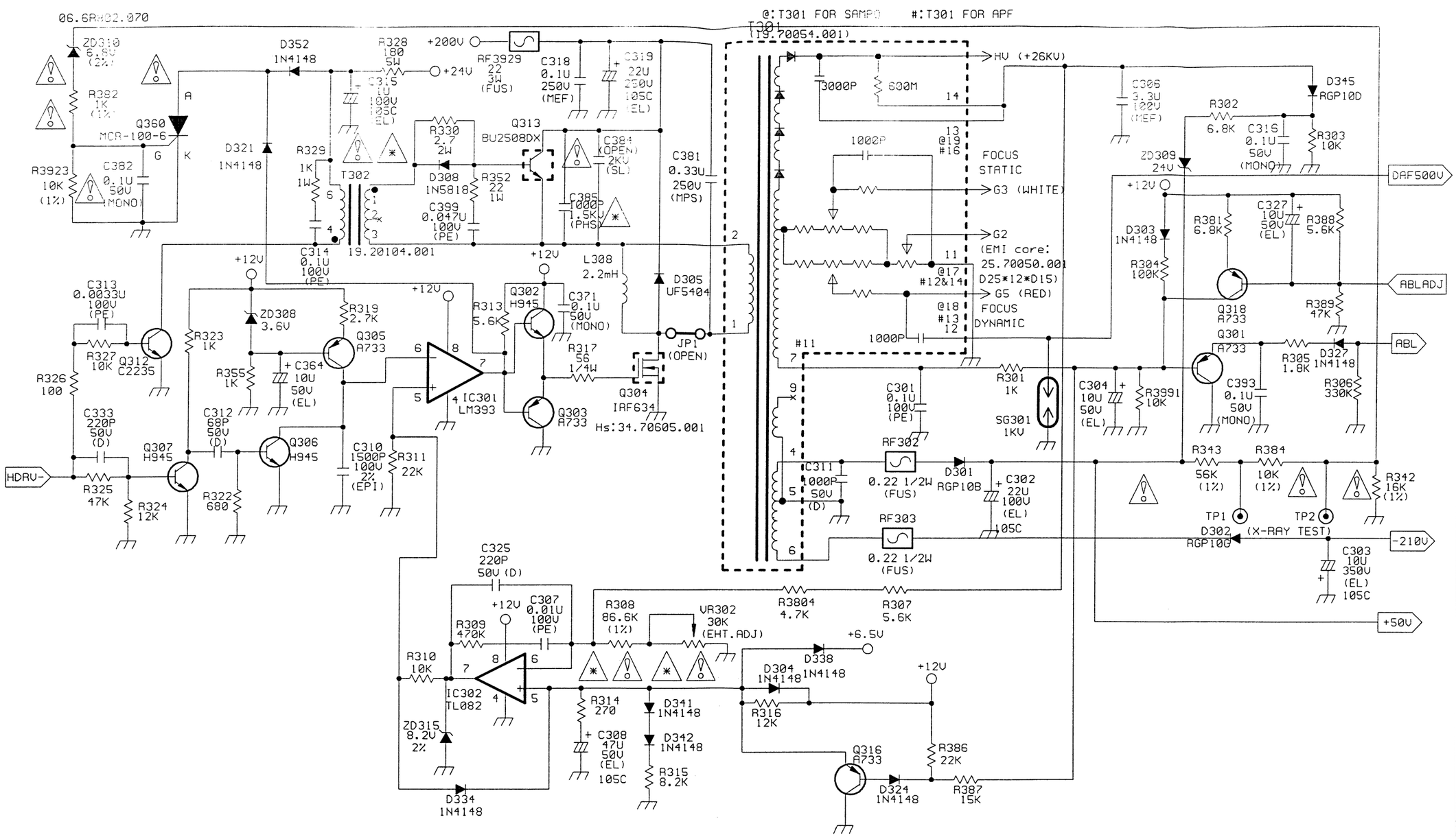
Acer 明碁電腦股份有限公司 Acer Peripherals, Inc.				
ACERVIEW 7299SL (MAIN:Deflection) SCHEMATICS				
SIZE A3	99SLM-B.SCH	FAB B	Doc.No. 304-C01	REV. 1
DATE : 12/29/1998		Sheet 1 OF 6		
Project Code. 91.71M02.001				
Prepared By	Revieued By	Approved By		
CHRIS PENG 12/29/98	TODD CHEN 12/29/98	SJ YANG 12/29/98		

NOTES:
1. Resistor values are in ohm, K=1,000 ohm, M=1,000,000 ohm
2. All resistors are 1/8 watt, 5% except where otherwise indicated
3. ⏚ ⏚ ⏚ Represents PCB common ground.

soft start & protection circuit

MC-Service

ACER 明碁電腦股份有限公司 Acer Peripherals, Inc.			
ACERVIEW 7299SL(MAIN:Deflection) SCHEMATICS			
SIZE A4	99SLM-B.SCH	FAB B	Doc.No. 304-C01 REV. 1
DATE : 12/29/1998		Sheet 2 OF 6	
Project Code. 91.71M02.001			
Prepared By	Reviewed By	Approved By	
CHRIS PENG 12/29/98	TODD CHEN 12/29/98	SJ YANG 12/29/98	



⚠ : The components identified by the mark of ⚠ in the schematic are important X-Radiation and Safety Parts. Should replacement is required, replace only with the same type and rating originally used.

✱ : The components identified by the mark of ✱ in the schematic are important safety parts. If replacement is required, refer to service manual to re-adjust and/or re-checked the B+ and High Voltage to reach the specified value.

NOTES: 1. Resistor values are in ohm, K=1,000 ohm, M=1,000,000 ohm
2. All resistors are 1/8 watt, 5% except where otherwise indicated
3. ⏚ ⏚ ⏚ Represents PCB common ground.

MC-Service

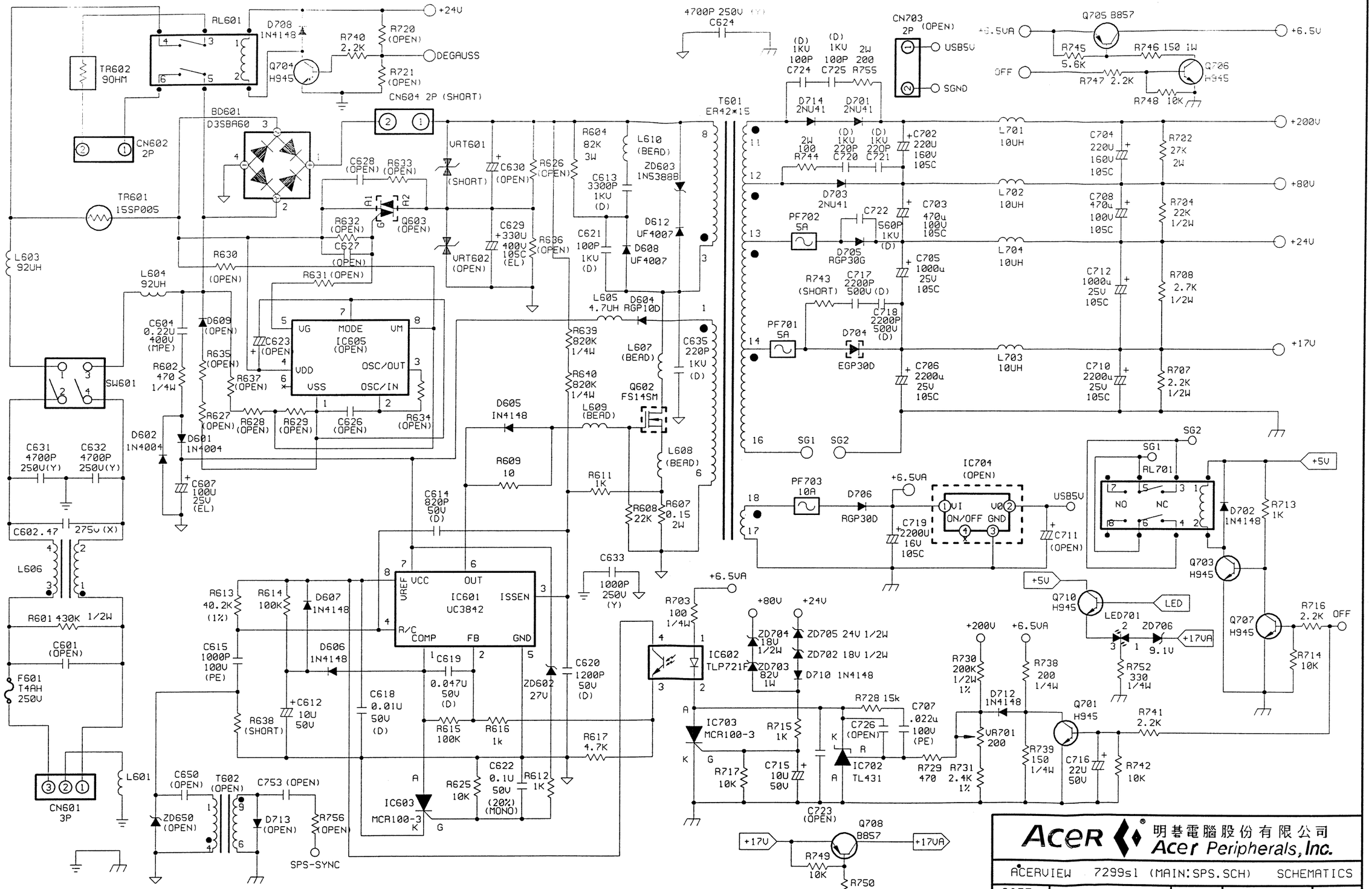
Acer 明碁電腦股份有限公司 Acer Peripherals, Inc.				
ACERVIEW 7299SL(MAIN:Deflection) SCHEMATICS				
SIZE A4	99SLM-B.SCH	FAB B	Doc.No. 304-C01	REV. 1
DATE : 12/29/1998		Sheet 3 OF 6		
Project Code. 91.71M02.001				
Prepared By	Reviewed By	Approved By		
CHRIS PENG 12/29/98	TODD CHEN 12/29/98	SJ YANG 12/29/98		

Fh(Hz) range	FC1
Fh<81K	0
Fh>=81K	1

NOTES:
1. Resistor values are in ohm, K=1,000 ohm, M=1,000,000 ohm
2. All resistors are 1/8 watt, 5% except where otherwise indicated
3. ⏚ ⏚ ⏚ Represents PCB common ground.

MC-Service

ACER 明碁電腦股份有限公司 Acer Peripherals, Inc.				
ACERVIEW 7299SL(MAIN:Deflection) SCHEMATICS				
SIZE A4	99SLM-B.SCH	FAB B	Doc.No. 304-C01	REV. 1
DATE : 12/29/1998		Sheet 4 OF 6		
Project Code. 91.71M02.001				
Prepared By	Reviewed By	Approved By		
CHRIS PENG 12/29/98	TODD CHEN 12/29/98	SJ YANG 12/29/98		



NOTES: 1.Resistor values are in ohm,K=1,000 ohm,M=1,000,000 ohm
2.All resistors are 1/8 watt except where otherwise indicated
3. ⏚ ⏚ ⏚ Represents PCB common ground.

	normal	standby	suspend/off
standby signal	high	low	low
OFF signal	high	high	low
LED signal	low	high	pulse

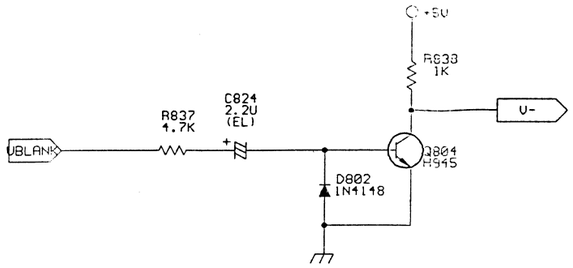
MC-Service

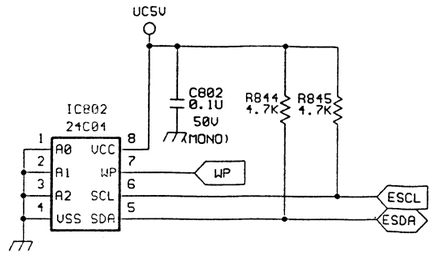
Acer 明碁電腦股份有限公司 Acer Peripherals, Inc.

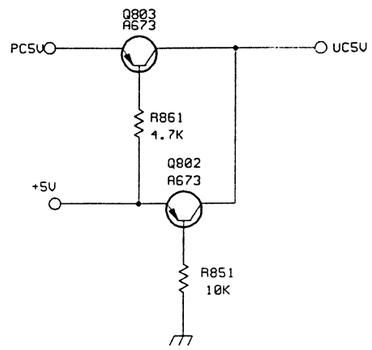
ACERVIEW 7299s1 (MAIN:SPS.SCH) SCHEMATICS

SIZE		FAB	Doc.No.	REV.
A4	99SLM-B.SCH	B	304-C01	1
DATE : 12/29/98		Sheet 5 OF 6		
Project Code. 91.71M02.001				

Prepared By	Reviewed By	Approved By
CHRIS PENG 12/29/98	MINTZ CHEN 12/29/98	SJ YANG 12/29/98





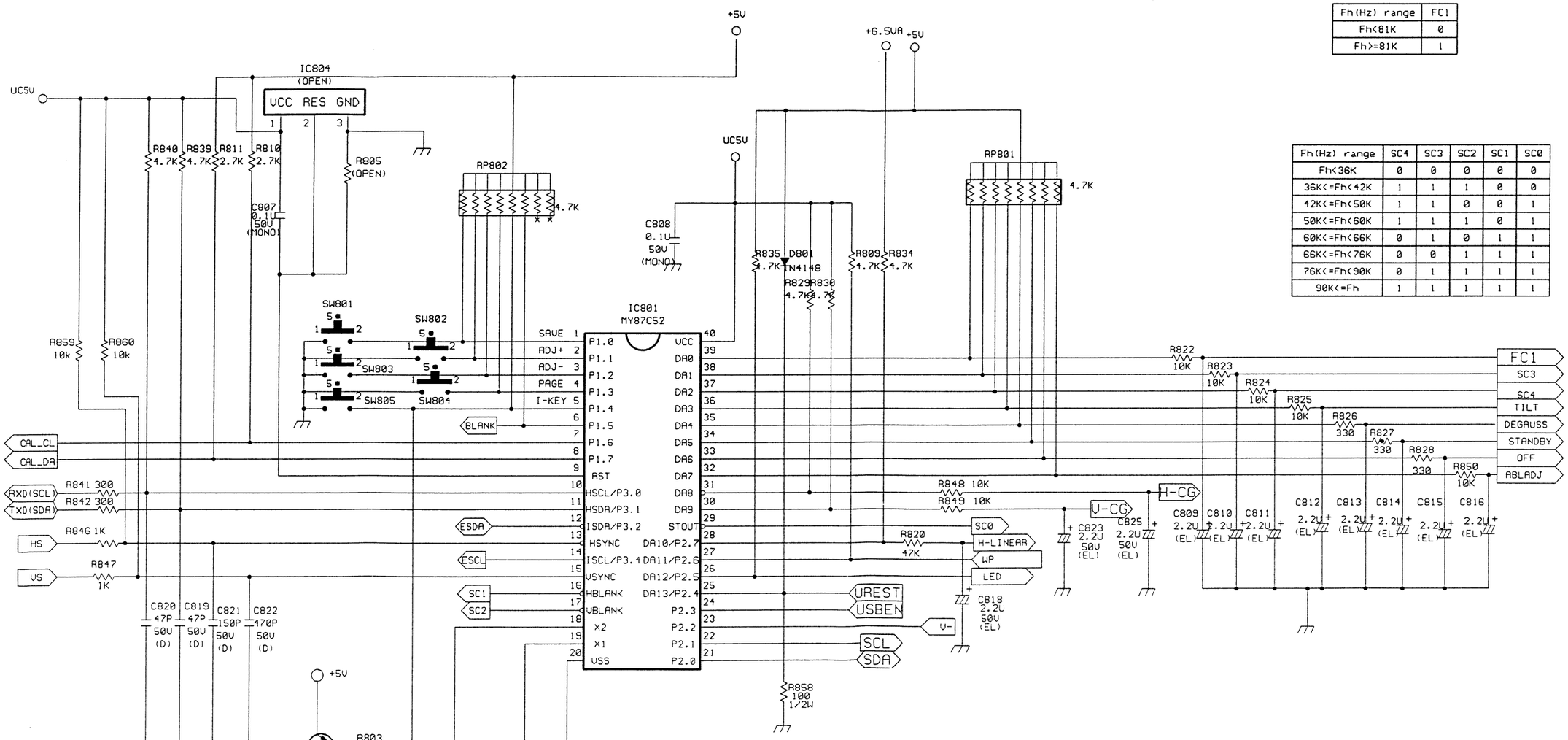


HOR. LINEAR VOLTAGE DATA

Fh(Hz) range	Q349 B	Q384 E
Fh<36K	1.2V	0.7V
36K<=Fh<42K	3.08V	2.57V
42K<=Fh<50K	3.6V	3.1V
50K<=Fh<60K	4.7V	4.2V
60K<=Fh<66K	4.98V	4.51V
66K<=Fh<76K	4.77V	4.3V
76K<=Fh<90K	5.07V	4.58V
90K<=Fh	6.08V	5.5V

Fh(Hz) range	FC1
Fh<81K	0
Fh>=81K	1

Fh(Hz) range	SC4	SC3	SC2	SC1	SC0
Fh<36K	0	0	0	0	0
36K<=Fh<42K	1	1	1	0	0
42K<=Fh<50K	1	1	0	0	1
50K<=Fh<60K	1	1	1	0	1
60K<=Fh<66K	0	1	0	1	1
66K<=Fh<76K	0	0	1	1	1
76K<=Fh<90K	0	1	1	1	1
90K<=Fh	1	1	1	1	1

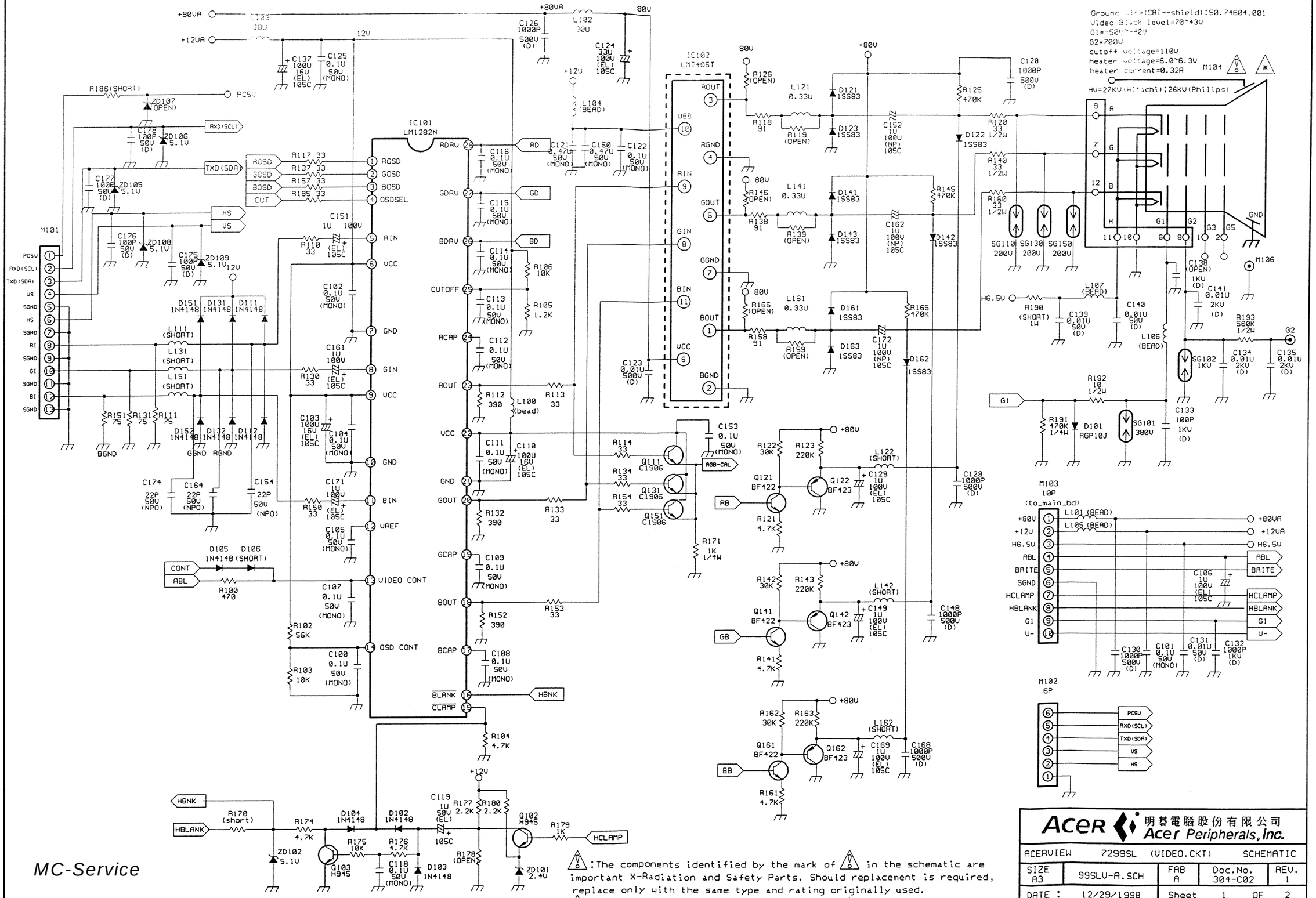


NOTES: 1. Resistor values are in ohm, K=1,000 ohm, M=1,000,000 ohm
2. All resistors are 1/8 watt, 5% except where otherwise indicated
3. ⏚ ⏚ ⏚ Represents PCB common ground.

MC-Service

Acer 明碁電腦股份有限公司 Acer Peripherals, Inc.

ACERVIEW	7299s1	(MICRO.CKT)	SCHEMATIC		
SIZE A3	99SLM-B.SCH	FAB B	Doc.No. 304-C01	REV. 1	
DATE : 12/29/1998		Sheet 6 OF 6			
Project Code. 91.71M02.001					
Prepared By	Reviewed By	Approved By			
CHRIS PENG 12/29/98	MINTZ CHEN 12/29/98	SJ YANG 12/29/98			

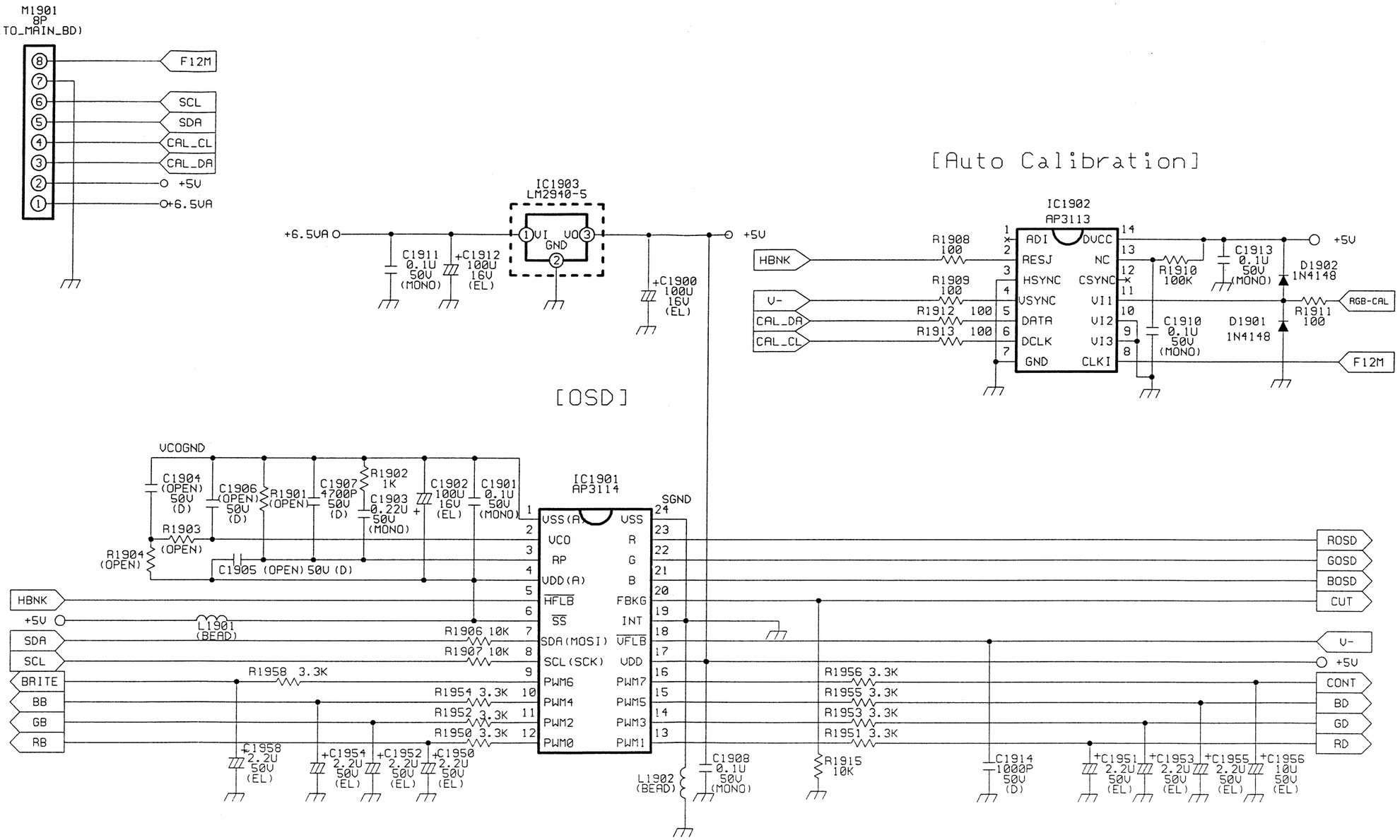


NOTES: 1. Resistor values are in ohm, K=1,000 ohm, M=1,000,000 ohm
2. All resistors are 1/8 watt, 5% except where otherwise indicated
3. Represents PCB common ground.

⚠ : The components identified by the mark of ⚠ in the schematic are important X-Radiation and Safety Parts. Should replacement is required, replace only with the same type and rating originally used.

✱ : The components identified by the mark of ✱ in the schematic are important safety parts. If replacement is required, refer to service manual to re-adjust and/or re-checked the B+ and High Voltage to reach the specified value.

ACER 明碁電腦股份有限公司 Acer Peripherals, Inc.			
ACERVIEW 7299SL (VIDEO.CKT) SCHEMATIC			
SIZE A3	99SLV-A.SCH	FAB A	Doc.No. 304-C02 / REV. 1
DATE : 12/29/1998		Sheet 1 OF 2	
Project Code. 91.72M02.001			
Prepared By	Reviewed By	Approved By	
CHRIS PENG 12/29/98	TODD CHEN 12/29/98	SJ YANG 12/29/98	



MC-Service

NOTES:
1. Resistor values are in ohm, K=1,000 ohm, M=1,000,000 ohm
2. All resistors are 1/8 watt, 5% except where otherwise indicated
3. ⏚ Represents PCB common ground.

Acer 明碁電腦股份有限公司 Acer Peripherals, Inc.				
ACERVIEW 7299G(VIDEO:OSD) SCHEMATICS				
SIZE A4	99SLV-A.SCH	FAB A	Doc.No. 304-C02	REV. 1
DATE : 12/29/1998		Sheet 2 OF 2		
Project Code. 91.72M02.001				
Prepared By	Reviewed By	Approved By		
CHRIS PENG 12/29/98	TODD CHEN 12/29/98	SJ YANG 12/29/98		